8

Chapter 8 - Water Resources

Existing Environment

Lake Michigan (near-shore and offshore)

Physical environment

Lake Michigan is the sixth largest freshwater lake in the world, the third largest of the Laurentian Great Lakes, and the only Great Lake entirely within the borders of the United States. Lake Michigan is 307 miles long, up to 118 miles wide, and up to 925 feet deep. The Lake has a surface area of 22,300 square miles, an average depth of 279 feet, and a volume of 1,180 cubic miles (1.29 x 10^{15} gallons).[94]

The near shore environment of Lake Michigan, adjacent to the ERGS, varies from a sand beach to quarried stone revetment. The quarried stone revetment begins at the existing coal dock and continues to the southern boundary of the federal rifle range property. North of the existing coal dock, there is a wide sand beach ranging from 60 to 150 feet wide, which helps to protect the toe of the bluff and helps reduce the rate of erosion along the steep clay bluffs.

Littoral process/currents

In coastal systems, beach sediments are transported along the shoreline as a result of waves combining with currents. This transport, known as "littoral drift," results in the creation of sandbars, pocket beaches and embayments cut into a beach. Littoral drift can move hundreds of thousands of cubic meters of sand along a coast each year. This section discusses how the ERGS project would change the littoral drift of sand, and the related changes in shoreline erosion rates.

The littoral drift of Lake Michigan at this location generally transports littoral material from the north to the south.[95] This is primarily controlled by northerly storms that largely occur during the winter months.[96] Structures such as breakwaters, jetties, and dredged navigational channels tend to trap littoral material behind the structure or move the material into deeper areas of the lake where it sinks. This interruption of littoral drift can exacerbate coastal erosion experienced at adjacent properties.

[94] The Great Lakes: An Environmental Atlas and Resource Book. United States Environmental Protection Agency / Environment Canada ISBN 0-662-23441-3

[95] US Army Corps of Engineers, 1992. USING MORPHOLOGY TO DETERMINE NET LITTORAL DRIFT DIRECTIONS IN COMPLEX COASTAL SYSTEMS. Coastal Engineering Technical Note II-30 (3/92).

[96] W. F. Baird & Associates Ltd., 2002. Coastal Analyses, Sediment Transport & Regional Impacts for the Elm Road Generating Station-Qualitative Assessment. (12/02).

To help understand the coastal processes occurring adjacent to the ERGS, WEPCO submitted a coastal analysis report which suggests that the ERGS project would reduce the transport of sand to the properties located downdrift (south) by an insignificant amount. Further, the analyses in this report conclude that this change in volume of sand transport would have an insignificant effect on shoreline erosion rates.

In order to reach these conclusions, WEPCO's consultant analyzed Lake Michigan water levels and wave conditions, calculated the historical rates of shoreline erosion based on aerial photography, and used numerical models to estimate sand transport along the shoreline. A "littoral cell" was identified as extending from the St. Francis shoreline near Howard Avenue south to the Racine Harbor. Coastal engineers frequently study shoreline processes within distinct "littoral cells," within which there is no sediment transport into or out of the littoral cell.

Shoreline, nearshore, and shoreline protection survey results were provided by WEPCO's consultant. These results were used to evaluate potential erosion rates along the shoreline. The shoreline within the littoral cell of the OCPP, is composed primarily of glacial till and glacial lake deposits, which have 20 to 50 percent sand content and the nearshore lakebed consists primarily of glacial tills with a few areas that are classified as Sandy or Bedrock nearshore lakebed.

The Coastal Study conducted by Baird for WEPCO at the ERGS facility evaluated the historical, current and predicted amount of littoral drift for this littoral cell. The analysis by Baird indicates that this littoral cell has the capacity to carry 170,000 m^3/ year (222,000 yd^3/year) of littoral material past the location of the OCPP site on an average annual basis. However, when Baird analyzed the possible inputs and outputs to the littoral process and evaluated the average annual recession rates of the shoreline, Baird found that even when no littoral barriers were constructed, i.e. pre-1950, the amount of littoral material transported, past where the existing power plant is located, was only approximately 62,000 m^3/year (81,000 yd^3/year). This suggests that even prior to any structural barriers along the shoreline, this littoral cell was starved for transportable material.

Changes related to shoreline modifications since 1952 and the OCPP construction

Since 1950, numerous structures have been placed along the shoreline including a number of large structures that effectively trap littoral material and prevent this material from being transported to the south. The largest of these structures include the Shore Waste Water Treatment Plant, the existing Oak Creek Power Plant and the Racine harbor. A number of additional shoreline modifications such as groins, riprap, bluff grading, and navigational dredging have further entrapped the littoral material bypassing the OCPP site. The impact of these structures and the construction of the existing OCPP facility are evident in the Coastal Analyses Report.

When structures are placed along a shoreline the bathymetry adjacent to the structure is altered over time in response to changes in littoral transport and waves. In comparing the historical bathymetric maps with the new bathymetric surveys conducted by WEPCO it is apparent that the lakebed profile adjacent to the power plant has changed in response to the construction of the existing coal dock. This comparison of historical and new bathymetric maps indicate that the lakebed south of the existing coal dock has experienced a gradual steepening of the lakebed profile, whereas the area north of the existing coal dock appears to have had a gradual accumulation of material resulting in shallower lakebed contours in this area. These changes are consistent with the current knowledge of coastal processes and the impacts of structures within littoral zones.

In addition, shoreline erosion rates downdrift (south) of the Oak Creek Power Plant appear to have increased since 1950. Analysis of historical aerial photos shows that prior to 1950, very few areas of the shoreline within the littoral cell had shoreline protection structures and the estimated annual shoreline recession rates for the properties located downdrift of where the OCPP was constructed, were on average less than 1.5 feet a year. However, these recession rates change dramatically between 1950 and 1970 when the existing OCPP facility was constructed along with many of the other large structures mentioned in the previous paragraph. These structures have trapped littoral material and prevented most of this material from being transported to downdrift shorelines. Bluff stabilization projects continued from 1970 to the present day and today only 2.4-km (1.5 miles) total out of 9 km (5.6 miles) of shoreline between the OCPP facility and Wind Point is unprotected by groins, jetties, or revetments. Since 1950, these unprotected shorelines have experienced drastic increases of shoreline recession rates of up to six feet per year.

The impact of the existing shoreline structures within this littoral cell is also evident in the estimated 2002 littoral transport rates, provided by Baird, which suggests that only approximately 3,000 m^3/year (3924 yd^3 /yr) is able to bypass the existing ERGS site. Baird also analyzed the grain size of this material to determine if this material was large enough to play a significant role in the stabilization of the downdrift shorelines. The conclusion of Baird's Coastal Analyses suggests that this small amount of littoral material, which is currently bypassing the site, is very fine and would not provide adequate protection to a shoreline south of the existing power plant. Based on this information Baird determined that the construction of the proposed harbor would not cause a significant impact on properties located downdrift (south) of the proposed harbor.

Geology / stratigraphy

The Wisconsin glaciation greatly influenced the geology of southeastern Wisconsin.[97] As ice sheets advanced and retreated in the Great Lakes basin, material was deposited and layers of differing material were formed on the land and within Lake Michigan. These glacial deposits, combined with the more recent deposits from the littoral processes of Lake Michigan and underlying bedrock, form the bed of Lake Michigan. This section describes the various geologic layers that comprise the bed of Lake Michigan.[98]

Overlying the bedrock are layers of lacustrine and glacial deposits. Lacustrine deposits are composed of unconsolidated and cohesionless sands and gravels which have generally been subject to the littoral processes. These deposits vary in thickness depending upon location. Underlying the lacustrine deposits are glacial deposits composed of alternating layers of lacustrine sand, silt, and clay and clay tills which are approximately 45 feet deep. The clay tills are cohesive sediments and have been compressed by the weight of glaciers. As a result, they tend to be stiffer, have lower water content, and greater density than the lacustrine soils.

The stratigraphic units encountered by Montgomery Watson Harza and Associates (MWH), the applicant's consultant, at the Elm Road site reflect a transition in depositional environments between those bedrock

[97] Montgomery Watson Harza, 2002. Geotechnical Data Report- Elm Road Generating Station Cooling Water Intake System prepared for WE Power, LLC. (November 2002).
[98] Southeastern Wisconsin Regional Planning Commission, 2002. Groundwater Resources of Southeastern Wisconsin. Technical Report No. 37. (June 2002).

units typically seen in the subsurface of Milwaukee and those found in the Chicago area. The bedrock beneath the lacustrine and glacial deposits consists of gently inclined sedimentary rock of the Silurian series. These consist primarily of dolomite of the Racine Formation, Waukesha Formation, Brandon Bridge member of the Joliet Formation, and the Kankakee Formation (see Figure 8-1).

Racine formation

The Racine formation is at the surface of the bedrock. At the site, this formation ranged in thickness from approximately 70 feet to over 120 feet thick. The rock is a light to medium gray fossiliferous dolomite.

Waukesha formation

The Waukesha formation underlies the Racine formation; the two units are differentiated by a change in rock texture. The Waukesha formation is less pitted, is light gray to buff in color and has an argillaceous and crystalline texture. The Waukesha formation at the project site ranges in thickness from 13 to 52 feet thick.

Brandon Bridge member

Lying below the Waukesha formation is the Brandon Bridge member. The Brandon Bridge member is composed of three distinct subunits. The upper unit of the Brandon Bridge is a light buff gray finely crystalline dolomite with numerous dark gray and green wavy shale partings and parting clusters. The upper unit average thickness is 43 feet.

The middle unit of the Brandon Bridge is argillaceous and crystalline and is differentiated from the upper unit by the appearance of red shale partings and layers. The middle unit is composed of light green and pink fine crystalline dolomite interbedded with green shale and reddish-brown shaley dolomite. The average thickness of the middle unit is approximately 34 feet.

The lower unit of the Brandon Bridge is marked by the disappearance of reddish-brown shale and shaley dolomite. The unit is thin to medium bedded green shaley dolomite with green shale partings and parting clusters. It is argillaceous to finely crystalline, fresh, medium hard to hard, and medium dense. The lower unit of the Brandon Bridge is the thinnest of the three subunits and averages five feet thick.

Kankakee formation

Underlying the Brandon Bridge member is the Kankakee formation, which is a medium to thick bedded light to medium gray buff, with fine to medium crystalline dolomite. Green and gray shale partings are also found throughout the formation. The thickness of the Kankakee formation is unknown for a portion of the sampling site because it was not fully penetrated as part of the sampling program conducted by MWH. However, two of the sampling cores that did penetrate through this formation found that it was approximately 63 feet to 70 feet thick.

Basal shale formation

The Basal shale formation underlies the Kankakee formation. The unit only appears in significant thickness in one sample, and only the upper 19 feet of the formation was penetrated. The unit is a reddish-gray shaley dolomitic mudstone and is soft to moderately hard, with areas that contain yellow staining.

Bathymetry

WEPCO completed a hydrographic survey in October 2002, which updated the bathymetric data of Lake Michigan within the project boundaries. The updated bathymetric data indicates that the elevation of the lake bed gradually decreases to the east. The near shore areas generally contain more irregularities on the surface than the offshore areas. However, there were a number of areas further offshore where there are prominent step-like features. (See Figure Vol. 2-9.)

Lakebed characterization

WEPCO contracted with the Great Lakes Water Institute to provide high resolution maps of bathymetry and characterize the substrate or habitat types for siting the water intake structure. The study characterized the substrate of Lake Michigan, offshore from the existing power plant beginning at 20-foot water depths up to 60-foot water depths. The lakebed was then categorized into four categories: 1) cobble or boulders; 2) cobble, gravel and sand; 3) hard clay outcrops; and 4) sandy or silty sand. The maps generated by the Great Lakes WATER Institute show that this area tends to consist of rock area between 20-to 30-foot water that the area of the proposed intake structure to consist of primarily sand. (See Figure Vol. 2-10)

Temperature

Lake Michigan experiences an annual temperature cycle which is influenced by weather conditions and seasonal fluctuations in solar radiation, ambient air temperature and wind speed.[99] Changes in these seasonal fluctuations have drastic impacts on the thermal stratification (the development of distinct layers within the lake based on temperature) of Lake Michigan. Water temperature in Lake Michigan varies from approximately 0°C (32°F) to 18°C (65°F). The annual temperature cycle can generally be broken down into three stages:

Fall turnover

Near the end of August the surface water layers become cool and become more dense than the deeper water layers which are warmer. This leads to the cooler surface water layers sinking via wave and wind action. This progressive sinking leads to a mixing of the cooler surface water with the deeper warmer water layers causing a cooling of the lake. This mixing continues until December when all layers of the lake are mixed to approximately 0°C (32°F) to 18 ºC (65ºF).

Winter stratification

This stage occurs from January until April when the surface water temperatures continue to cool to below 4° C due to wind energy, ambient air temperature, and possibly ice formation. This layer of cooler water then lies over a deep warmer water which remains approximately 4°C.

Spring/summer warming and stratification

In May and June the surface water layers warm to a temperature above 4°C and form a distinct thermal bar (often clearly visible) that expands and starts moving offshore until the entire surface layer of the Lake is warmed to well above 4°C (39°F). As the summer progresses and until August, the surface water layers continue to warm and a thermocline (an area in the lake where water temperature decreases very steeply) is formed. The warmer water floats on top of the cooler denser water, and very little mixing occurs. As the summer progresses the surface layer continue to increase in temperature and the thermocline deepens. This continues until the Fall Turnover stage.

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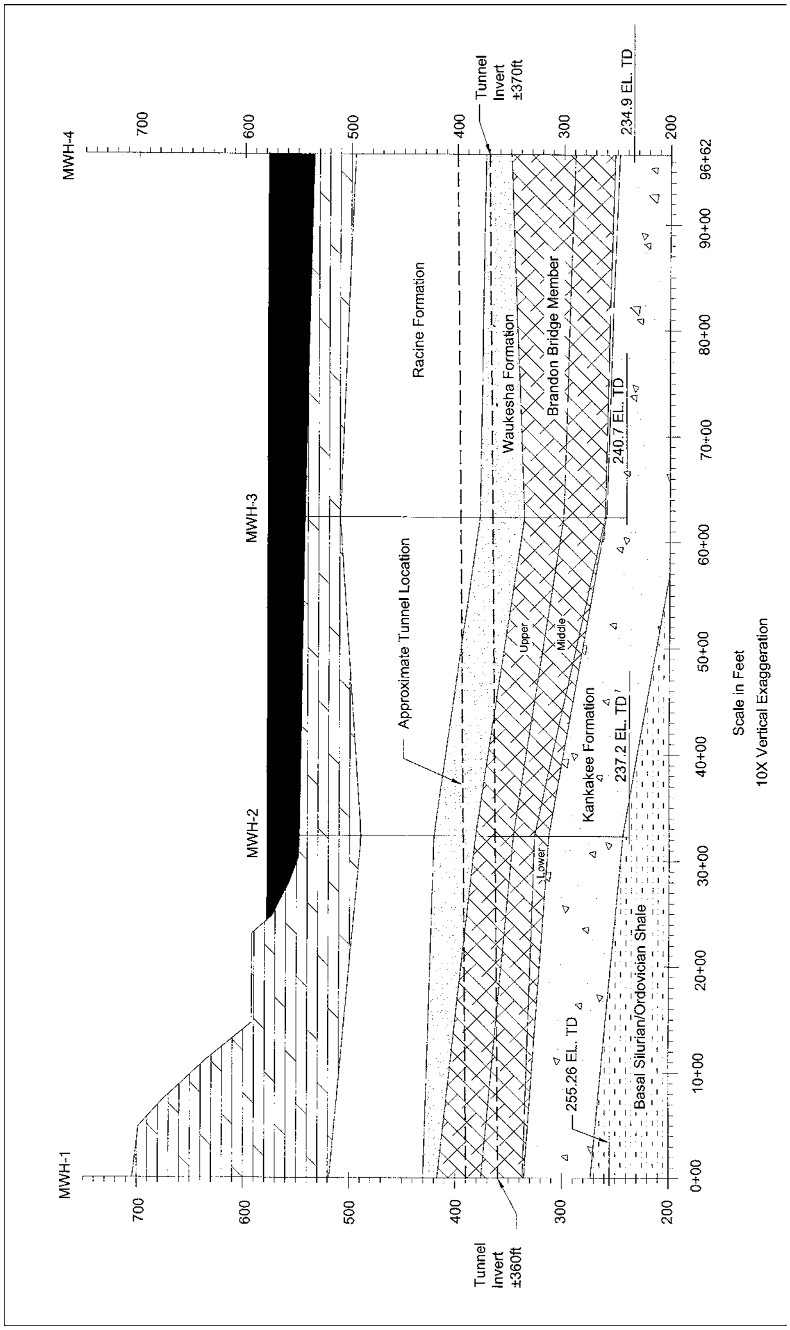
[99] Mortimer, Hiley Center for Great Lakes Studies. 1971. Large-Scale Oscillatory Motions and Seasonal Temperature Changes in Lake Michigan and Lake Ontario. Special Report No. 12 Part I.

Figure 8-1 Stratigraphy of the near shore bedrock of Lake Michigan at the OCPP site



Biological environment

Vertebrates

The Lake Michigan fishery consists of nearly 100 species. The table below lists the species that are commonly found in the near shore waters of Lake Michigan. The fish community in Lake Michigan has undergone considerable changes since the construction of the Welland Canal around Niagara Falls in the early 1900's. The Welland Canal allowed marine species, notably the alewife and sea lamprey, to invade the upper Great Lakes. The sea lamprey, along with over-fishing, led to dramatic declines in the numbers of native piscivorous fish. This decline allowed the alewife population to explode, which led to significant declines in native fish species, including lake herring, lake whitefish, chubs and yellow perch. Sea lamprey control and fish stocking programs have increased predator fish numbers and stabilized alewife numbers.

An additional benefit of the stocking program has been the development of a popular sport fishery.

Table 8-1 Fish species commonly found in near shore waters of Lake Michigan

Brook trout	Rainbow smelt	Sand shiner	Walleye
Brown trout	Alewife	Fathead minnow	Johnny darter
Lake trout	Gizzard shad	Longnose sucker	Rock bass
Rainbow trout (Steelhead)	Lake chub	White sucker	Trout-perch
Chinook salmon	Emerald shiner	Burbot	Three-spine stickleback
Coho salmon	Spottail shiner	Slimy sculpin	Nine-spine stickleback
Lake whitefish	Longnose dace	Yellow perch	Brook stickleback
Round whitefish	Common carp	Smallmouth bass	Round goby
Bloater chub	Bluntnose minnow	Largemouth bass	

The annual stocking of six species maintains the Wisconsin Lake Michigan trout and salmon fishery. This stocking consists of two native species (lake trout and brook trout) and four introduced species (Chinook and Coho salmon, Brown trout and Steelhead). The five-year average stocking levels for Milwaukee and Racine Counties is listed in the table below.

Stocking locations near the proposed project area include Bender Park, Oak Creek, Green Can Reef and South Milwaukee Reef. Only lake trout would be stocked on the two reefs, while all the species could potentially be stocked at Bender Park. Stocking in the Oak Creek proper could include all of the trout and salmon species except for lake trout.

Table 8-2 Salmonid species and numbers of fish stocked in Milwaukee and Racine Counties

Five-year Average of Salmonid Species Stocked in Milwaukee and Racine Counties (1997– 2001)						
County	Brook Trout	Brown Trout	Chinook Salmon	Coho Salmon	Lake Trout	Steelhead
Milwaukee	18,268	109,397	157,808	32,142	160,014	56,583
Racine	5,370	105,642	146,795	56,747	58,860	95,994
Total	23,638	215,039	304,603	88,889	218,874	152,577

Wisconsin DNR sport fishing surveys estimated fishing effort and harvest in Racine and Milwaukee Counties. Angler hours ranged from 201,774 angler hours in 2000 to a high of 360,474 angler hours in 2001. The average angler hours spent fishing in these two counties on Lake Michigan was 530,157 per year. Harvest estimates were calculated for a variety of salmon and trout species as well as native species. Harvests ranged from zero for several species to 44,013 Coho salmon in 1997. Anglers in Racine harvested an average of 67,562 fish from 1997 to 2001 while Milwaukee area anglers harvested an average of 61,122 fish from 1997 to 2001. The creation of Bender Park has increased access to Lake Michigan for Milwaukee County anglers and has made it easier to access the warm water discharge from the Oak Creek Power Plant.

Anglers concentrate in this area in the spring and fall to catch brown trout. It is also used heavily during the summer to harvest yellow perch.

Table 8-3 Estimates of fishing effort in Racine and Milwaukee Counties

Estimates of Fishing Effort (hours) Calculated by Wisconsin DNR, 1997-2001						
County	1997	1998	1999	2000	2001	Average
Racine	302,364	232,660	260,600	201,774	256,390	**250,757.6**
Milwaukee	283,356	295,991	244,605	212,570	360,474	**279,399.2**
Total	**585,720**	**528,651**	**505,205**	**414,344`**	**616,864**	**530,156.8**

Table 8-4 Estimates of Lake Michigan Fish Harvest in Racine County

Harvest Estimates for Racine County Calculated by Wisconsin DNR, 1997-2001.						
Species	1997	1998	1999	2000	2001	Average
Coho Salmon	44,013	10,170	15,979	19,788	12,047	**20,399.4**
Chinook Salmon	8,619	8,344	17,796	20,137	16,046	**14,188.4**
Rainbow Trout	9,803	9,329	7,619	5,439	11,664	**8,770.8**
Brown Trout	4,739	1,979	3,317	4,475	3,132	**3,528.4**
Brook Trout	2	2	9	7	0	**4.0**
Lake Trout	9,710	16,603	11,526	8,838	8,224	**10,980.2**
Northern Pike	8	6	0	0	16	**6.0**
Smallmouth Bass	0	0	0	0	0	**0.0**
Yellow Perch	7,016	5,201	6,482	2,512	27,213	**9,684.8**
Walleye	0	0	0	0	0	**0.0**
Total	**83,910**	**51,634**	**62,728**	**61,196**	**78,342**	**67,562**

Table 8-5 Estimates of Lake Michigan Fish Harvest in Milwaukee County

Harvest Estimates for Milwaukee County Calculated by Wisconsin DNR, 1997-2001						
Species	1997	1998	1999	2000	2001	Average
Coho Salmon	23,212	10,436	5,717	16,705	8,989	**13,011.8**
Chinook Salmon	10,089	15,278	11,677	9,339	19,578	**13,192.2**
Rainbow Trout	7,114	12,715	5,450	3,392	11,068	**7,947.8**
Brown Trout	11,536	7,550	3,169	9,463	3,921	**7,127.8**
Brook Trout	59	30	0	5	39	**26.6**
Lake Trout	5,069	5,300	1,589	2,248	4,473	**3,735.8**
Northern Pike	164	183	0	0	173	**104.0**
Smallmouth Bass	53	19	30	0	0	**20.4**
Yellow Perch	1,482	4,686	6,330	5,633	61,074	**15,841**
Walleye	353	194	25	0	0	**114.4**
Total	**59,131**	**56,391**	**33,987**	**46,785**	**109,315**	**61,121.8**

Data from commercial yellow perch fishermen as reported to the DNR show an average of 94,671 pounds of yellow perch (*Perca flavescens*) harvested annually from 1992 to 1996 in Lake Michigan locations close to the proposed Elm Road facility. Pounds harvested ranged from 11,420 in 1996 to 137,270 in 1992. Commercial fishing for yellow perch was closed in the fall of 1996 due to the decline in the yellow perch population and is represented by the decline in the harvest from 137,270 to 11,420 pounds from 1992 to 1996.

Table 8-6 Commercial harvest of yellow perch in locations near the ERGS from 1992-1996

Commercial Harvest (pounds) of yellow perch in Grids 1901, 1902, 2002 and 2102, 1992 – 1996						
	1992	1993	1994	1995	1996	Average
Yellow Perch	137,270	126,681	123,419	74,565	11,420	**94,671**

Estimates of the yellow perch population in southern Lake Michigan were calculated using DNR surveys, assessments and other sources. Yellow perch populations were estimated to be over 20,000,000 fish in Wisconsin waters off Lake Michigan in 1986. Strong year-classes in the mid-1980's created a large population that was fished heavily by both sport and commercial anglers. Poor recruitment in the 1990's was caused by unknown factors which may include poor weather, low abundance of female spawners, reduction in zooplankton abundance and increased vulnerability to predators.

Recent trends show a marked decline in the overall numbers dropping to less than 500,000 in 1998. However, a modest year class in 1998 increased the overall yellow perch population in the late 1990's. Wisconsin DNR SCUBA surveys show increased egg deposition on traditional yellow perch spawning grounds since 1997. Now that the 1998 year-class of yellow perch are fully mature, egg deposition and potential for production of another modest year-class may be good over the next couple of years.

Figure 8-2 Yellow perch population estimate (number) for southern Wisconsin's Lake Michigan waters, 1986-2001

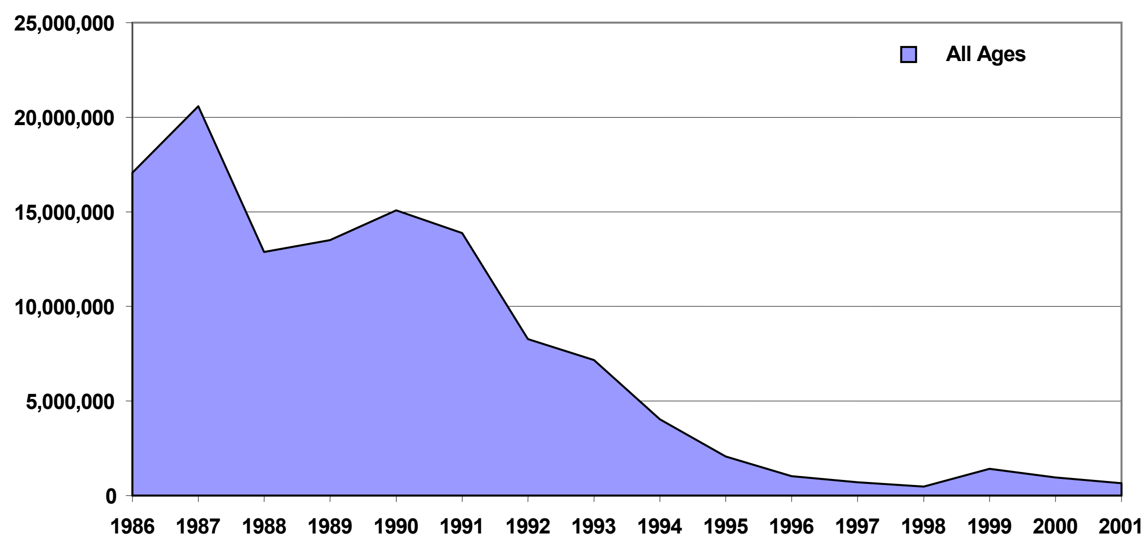


Table 8-7 Yellow perch dive summary conducted by DNR for the years 1997- 2002

Wisconsin DNR Yellow Perch Dive Summary from 1997 to 2002					
Year	Diver bottom time (hrs)	# Egg masses found	Area covered (m2)	# Egg masses per 1000 m2
1997	31:40	9	18,000	0.50
1998	12:48	0	9,200	0.00
1999	-	-	-	-
2000	1:10	8	4,225	1.89
2001	4:30	223	30,600	7.29
2002	8:00	573	49,701	11.53

Reproduction and spawning

While natural reproduction has not been documented, lake trout are known to spawn on both the Green Can and South Milwaukee Reefs. Green Can Reef is located off of St. Francis, while the South Milwaukee Reef is located approximately 3.5 miles off the mouth of Oak Creek (the creek) in 25 to 55 feet of water. Spawning runs of anadromous trout and salmon occur annually on rivers and stream tributaries of Lake Michigan. Chinook salmon, Coho salmon, Brown trout, Brook trout and Rainbow (Steelhead) trout all utilize Oak Creek as a spawning site, although natural reproduction does not occur.

Yellow perch spawning in Lake Michigan occurs on boulder and rubble reefs in the near shore waters. The Green Can Reef is the major yellow perch spawning location in the area but spawning also occurs on similar habitat along the shoreline, such as the South Milwaukee Reef.

Alewife spawn in the near shore waters of Lake Michigan from June to August, with inshore migration beginning in May. The population of alewives has fluctuated widely, from the extreme levels seen in the late 1960's and early 1970's to much lower numbers at present. Despite the drop in population, alewives remain the dominant forage species in the diets of trout and salmon in Lake Michigan. The number of alewives in the near shore waters varies seasonally, with a large inshore movement coinciding with spawning, followed by offshore movement following spawning. In winter, alewives seek the warmest water available and are typically found in deep water. An annual die-off is associated with the spawning migration, either from spawning stress or fluctuations in water temperature.

The table below lists the spawning requirements of a selected number of Lake Michigan fish species. The list includes species resident to the project area, as well as those that may be seasonally or temporally abundant. Habitat for spawning is available for all of the listed species in the general vicinity of the proposed intakes, but this habitat is not necessarily limited to the project area. The availability of spawning habitat outside of the project area should mitigate potential losses due to construction, but all necessary precautions must be taken to minimize disturbance of the existing habitat. Losses due to entrainment and impingement are potentially greater for those species with pelagic eggs or larvae. Data from previous entrainment and impingement studies at the Oak Creek Power Plant support this, with higher densities of alewife larvae entrained during the periods of highest overall abundance (July and August). Entrainment of yellow perch larvae followed a similar trend, with densities highest in late June and early July (WEPCO, 1976; EA Engineering 2003).

Weather and currents, both internal and wind-driven, influence the presence and density of eggs and larvae in the project area. Thus, entrainment and impingement losses could vary depending on temporal and environmental differences. However, the best available means for reducing losses due to entrainment and impingement should be implemented in the final design of the intakes. Finally, additional entrainment and impingement studies should be implemented following completion of the intakes to assess the affects of mitigating technologies.

Table 8-8 Spawning requirements for selected Lake Michigan fish

Species	Habitat	Spawning Period	Temperature	Egg/Larval Characteristics
Lake Trout	Near shore and offshore reefs; boulder/cobble/ honeycomb rock	October-November	37 – 58 F	Semi-buoyant, 5-6mm diameter/demersal
Rainbow Trout	Streams; gravel	January – May, depending on strain	38 – 50 F	Semi-buoyant, 4-5 mm diameter/demersal
Brown Trout	Streams; gravel	September – January	35 – 55 F	Semi-buoyant, 5-7 mm diameter/demersal
Chinook Salmon	Streams; gravel	September – October	37 – 50 F	Demersal, 6-7 mm diameter/demersal
Coho Salmon	Streams; gravel	October – November	40 – 57 F	Demersal, 5-6 mm diameter/demersal
Round Whitefish	Near shore waters; stone, gravel, rocky reefs & honeycomb rock	October – December	32 – 40 F	Demersal, 2.9-3.5 mm diameter/demersal
Bloater	Open water, eggs broadcast pelagically	December – March	Not reported	Semi-buoyant, demersal, 1.9-2.3 mm diameter/demersal
Alewife	Shorelines, tributaries and protected near shore areas; eggs broadcast pelagically	May – August	55 – 70 F	Demersal, adhesive, 0.95-1.3 mm/pelagic
Gizzard Shad	Harbors and river mouths; eggs broadcast pelagically	May – August	60 – 77 F	Demersal, adhesive, 0.9-1.1 mm/pelagic
Spottail Shiner	Shallow inshore waters, typically over *Cladophora*	June – July	64 – 72 F	Demersal, adhesive until water-hardened, 1.0-1.4 mm/pelagic
Common Carp	Vegetated areas of inshore waters	May – August	59 – 77 F	Demersal, adhesive, 1.5-2.1 mm diameter/demersal
Longnose Dace	Streams and shoreline areas; sand, gravel and rubble	June – July	52 – 75 F	Demersal, adhesive, 2.1-2.7mm diameter/pelagic
Longnose Sucker	Streams; gravel or sand	April – May	36 – 59 F	Demersal, non-adhesive, 3 mm diameter/pelagic
White Sucker	Riffles and pools of streams; gravel	April – May	50 – 68 F	Demersal, non-adhesive,2-3.6 mm diameter/pelagic
Yellow Perch	Near shore reefs; boulder/rubble/cobble	May – June	40 – 60 F	Semi-demersal, non-adhesive, 1.9-3.5mm diameter/pelagic
Smallmouth Bass	Sheltered bays and tributaries; rock, gravel and course sand	May – June	55 – 75 F	Demersal, adhesive,1.8-2.8 mm diameter/demersal
Slimy Sculpin	On bottom in 30 – 90 meters of water; fine sand to mud	April –May	37 – 53 F	Demersal, adhesive, 2-3 mm diameter/demersal

1975-1976 impingement/entrainment study

A year-long impingement/entrainment study conducted by WEPCO at the Oak Creek Power Plant from March 1, 1975 through February 29, 1976 estimated that a total of 2,754,118 fish weighing 109,414 pounds were impinged at the plant during the sampling year. Alewife comprised 77.9 percent (2,145,500) by number and 88.6 percent by weight (97,000 pounds) while smelt accounted for 20.6 percent and 8.7 percent by number and weight, respectively. Eighty-five per cent of these fish were taken in May, June, and July coincident with the spawning period and the annual die-off (WEPCO 1976). Estimates for the monitoring year projected the impingement of 635 trout and 190 salmon. From impingement collections, it appears that almost all of these fish would be juveniles, probably freshly stocked.

It is estimated that 6,202,407 fish larvae were entrained during the April-October period. Of these, 17 percent were alewife, 76 percent smelt, and 2 percent were sculpin. Almost 90 percent of the larvae (juveniles) were entrained in August and September, before leaving the near shore zone. Total egg entrainment was projected at 9,281,370 with alewife comprising 98 percent of the total.

Ichthyoplankton sampling

In 2002, EA Engineering, Science and Technology conducted ichthyoplankton sampling for WEPCO using plankton tows and pumps at various depth contours, water depths and locations. A total of 384 ichthyoplankton collections were made at 14 Lake Michigan locations in the area of the Oak Creek and proposed Elm Road Power Plants. A total of 18,233 fish eggs and larvae were collected, 15,173 by the netting programs and 3,066 by pumping (EA Engineering, Science and Technology, 2002).

The net samples were dominated by alewife larvae (*Alosa pseudoharengus*) (79.5 percent), followed by alewife/spottail shiner (14.1 percent) and yellow perch larvae (4.5 percent). Total ichthyoplankton densities for depths combined were significantly different among the five depth contours. For contours combined there were no significant differences between surface, mid depth and bottom for total ichthyoplankton, larvae or egg densities. Statistical comparisons between months of mean ichthyoplankton densities showed that each month was significantly different for total ichthyoplankton and larvae densities while June and July had egg densities that were similar to one another and which were significantly higher than in August and September (EA Engineering, Science and Technology, 2002).

The bottom pump samples yielded 53 larvae and 3,013 eggs representing 5 taxa. The samples included 2,956 alewife/spottail shiner eggs (96.4 percent) and 57 trout-perch/common carp eggs (1.9 percent). Larval specimens were dominated by mottled/slimy sculpin and alewife. Total ichthyoplankton densities for pump samples were significantly different among the five depth contours and between months. For total ichthyoplankton and eggs, June and July densities were significantly higher than August and December (EA Engineering, Science and Technology, 2002).

Invertebrates

Benthic macroinvertebrates

A 1998 survey of the Great Lakes identified 20 taxa of benthic macroinvertebrates in Lake Michigan with an average of about seven taxa per sampling site (Barbiero and Tuchman, 2000). As a whole, the amphipod *Diporeia* (formerly *Pontoporeia*), tubificid oligochaetes, and sphaeriid snails dominated the Lake Michigan benthic macroinvertebrate community. However, in near shore areas, oligochaetes were the dominant taxonomic group. The density of benthic macroinvertebrates typically ranged from 1,500 to 6,500 organisms per square meter. Additional surveys performed during 2002 within the project area by the Great Lakes

Water Institute reveal oligochaetes and chironomidae as present, as well as fresh water sponges, Ectoprocta, mayflies, leeches, isopods, and amphipods. Zebra mussel infestation was also confirmed on most suitable habitat.

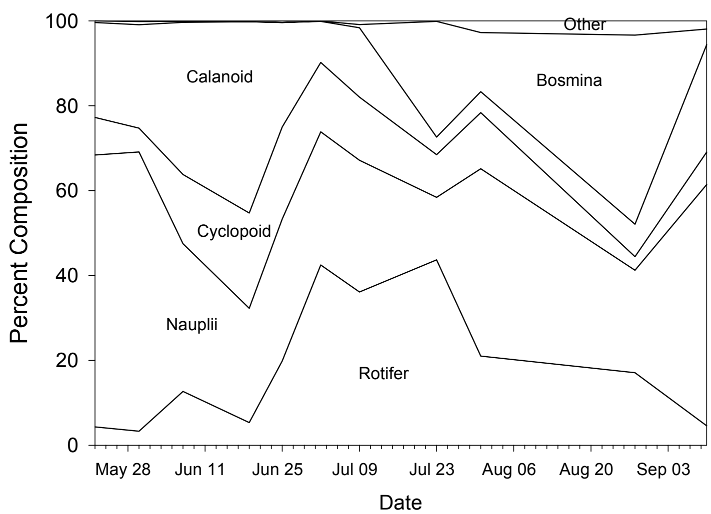
Over the past several decades, Lake Michigan's southern basin has undergone major shifts in nutrient loading and has been invaded by the zebra mussel. Reductions in nutrient loadings have reduced the overall productivity of the lake and produced a decline in the density of benthic macroinvertebrate fauna, particularly oligochaetes and snails, observed between 1980 and 1987 (Nalepa, et al. 1998). The year 1988 marked the beginning of colonization of southern Lake Michigan by the zebra mussel and the beginning of a decline in the abundance of *Diporeia*. Nalepa et al. (1998) hypothesized that the filtering feeding by zebra mussels in near shore waters decreased the amount of food available to the amphipod.

Zooplankton

The Illinois Natural History Survey has conducted spring and summer zooplankton tows off Waukegan Harbor for the past decade. Zooplankton was generally sampled weekly from May 22 to September 10 and on the same nights as larval fish collections (June-July) in 2001. Replicate vertical lifts were collected at two 10-m sampling sites with a 0.5-m diameter, 73-µm mesh net. Mean volume of water filtered in each vertical lift was 1.9 m^3.

In 1988, mean zooplankton density for the same period was 54 individuals per liter. In comparison to previous mean June-July zooplankton densities, the 2001 value was lowest at less than 10 individuals per liter. Zooplankton density varied seasonally in 2001. During early June densities were low, but by July densities increased, largely due to the appearance of rotifers.

Figure 8-3 Percent composition of zooplankton found in near shore Illinois waters of Lake Michigan near Waukegan during May through September 2001.



Copepod nauplii and calanoid copepodites dominated the near shore zooplankton assemblages during May and June (Figure 8-3). By late June, rotifer composition increased to 40 percent of the species composition and continued at this level through late July. In late July rotifer composition decreased and *Bosmina* increased. Other cladocerans (e.g., *Polyphemus*, *Ceriodaphnia*, *Leptodora*, *Diaphanosoma*, *Chydoridae*) which were commonly found in samples during 1988-1990 have been rarely observed in samples collected since 1996. Additionally, the exotic Spiny water flea, *Bythotrephes cederstroem* has become established in Lake Michigan.

Overall, studies undertaken between 1983 and 1992 on Lake Michigan as a whole collected 71 different species, representing 38 genera of zooplankton (Makarewicz, 1994). Rotifera accounted for the largest number of species, with Cladocera, Calanoida and Cyclopoida as a group having the greatest biomass. Using biomass, Makarewicz classifies Lake Michigan's trophic state between the oligotrophic and mesotrophic.

Plants

Macrophytes

Lakebed surveys within the project area were undertaken in 2002 by the Great Lakes WATER Institute. Those studies show no aquatic macrophytes within the project area. Most of the project area is in water depths deeper the maximum rooting depth of macrophytes (Eurasian Watermilfoil, Coontail, and Elodea) commonly found in Lake Michigan. Those areas that are shallow enough to normally support macrophytic growth are subject to long-shore drift and high-energy wave action.

Algae

Free-floating algae are present in Lake Michigan, dominated by the diatoms, represented by *Synedra, Fragilaria, Tabellaria, Asterionella, Melosira, Cyclotella* and *Rhizosolenia,* among others. Concentrations of free-floating algae fluctuate during the year, subject to the availability of sunlight, water temperatures, and in the cases of diatoms, bio-availability of silicon.

Algae typically found attached to substrate are also present in Lake Michigan. These include *Cladophora*, *Ulothrix*, *Tetraspora, Stigeoclonium*, and red algae *Asterocytis*. The presence of *Cladophora* has been confirmed within the project area.

Existing off-shore facilities

Breakwater and coal dock

The existing structures located along the shoreline of the ERGS include a 19-acre coal dock constructed some time in the early 1950's, two breakwater structures and shoreline revetment south of the existing coal dock. A 600-foot breakwater extends out from the southeastern corner of the coal dock. This breakwater was installed in 1998 to reduce the migration of littoral material drifting into the intake channel. The intake channel, which was built during the initial plant construction, is formed to the north by the existing coal dock and a 900 foot long breakwater to the south. The existing shoreline revetment begins just south of the intake channel and continues to the northern edge of the rifle range property. The revetment consists of steel sheet pile walls which have large fieldstone or quarrystone in front of the sheet pile.

Intake structure

Prior to 1985, the OCPP consisted of two separate plants with four boiler/turbine units in two buildings. Units 1-4 were located in the north plant, and units 5-8 were in the south plant. The condenser cooling water system employed a "once-through" design to condense the boiler steam after it passes through the turbine. The complete condenser cooling water system consisted of a common on-shore intake channel, two pumphouses, eight traveling screens (five in the south plant and three in the north plant), eight circulating water pumps, eight condensers, and five discharge points. The four circulating water pumps serving units 1-4 were rated at 110,000 gpm each. The four circulating water pumps serving units 5-8 were rated at 198,000 gpm each.

The existing intake structure, shown in Figure 8-4 consists of a 900-foot long, approximately 200-foot wide, and 25-foot deep approach channel along the south side of the existing coal dock.

Existing impingement and entrainment levels

Impingement refers to the contact between an aquatic organism, usually an adult or juvenile fish, and a screening structure that removes debris from the cooling water as it enters the intake system. At the Oak Creek Power Plant, organisms can be impinged first at the bar racks, and then at the traveling screens.

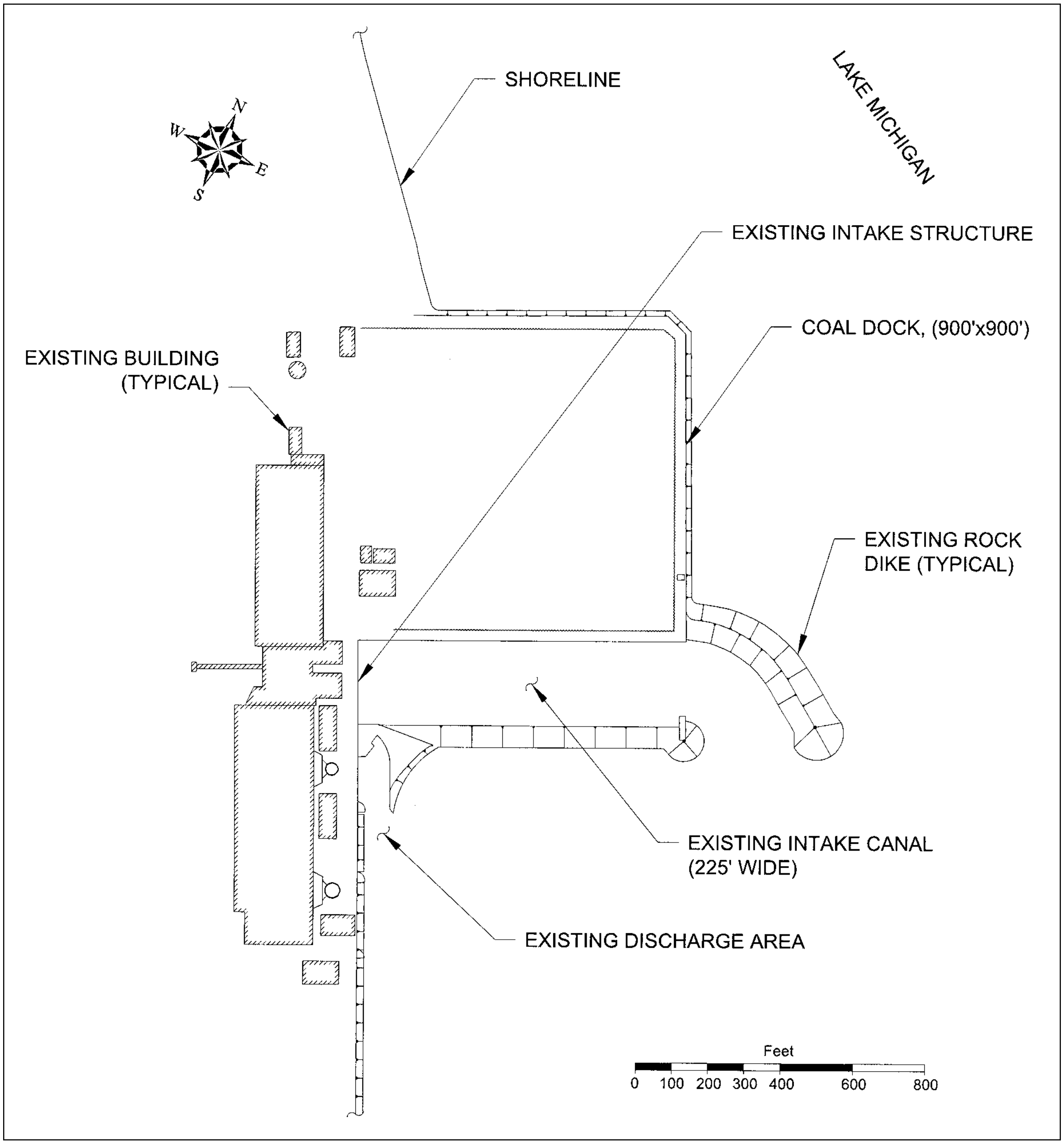
One of the requirements of the WPDES (discharge) permit that the DNR issued was a monitoring study to determine the environmental impact of the power plant's cooling water intake system. The study was conducted from March 1, 1975 to February 29, 1976. During the study period, all eight of the coal-fired units were in operation. Maximum velocities approaching the traveling screens ranged from 1.04 to 1.36 feet per second, depending on lake level.

Impingement sampling was conducted by collecting all fish backwashed off of the three traveling screens in the north pump house. The trash rack was not observed to have any impinged fish. For this study, it was assumed that all impinged fish suffer 100 percent mortality. It was estimated that 2.8 million fish weighing 109,000 pounds were impinged. Alewife comprised 78 percent of the catch by number and 89 percent by weight. Smelt accounted for 21 percent and 9 percent by number and weight, respectively. Forage fish added 1 percent and 2 percent by number and weight. Salmonids were negligible.

Entrainment sampling was conducted using plankton nets. Sampling occurred between the trash rack and traveling screens. For this study, it was assumed that all entrained organisms suffer 100 percent mortality. Sampling was also conducted for larvae and fish eggs at in the near shore zone, beyond the influence of the approach channel. It is estimated that 6.2 million fish larvae were entrained during the April – October period. Of these, 17 percent were alewife, 76 percent smelt, and 2 percent sculpin. Almost 90 percent of the larvae were entrained in August and September, before leaving the near shore zone. Total egg entrainment was projected at 9.3 million, with alewife comprising 98 percent. *Pontoporeia* and *Mysis* entrainment was estimated at 12.6 and 3.0 million, respectively.

The absolute magnitude of the number of fish, larvae, or eggs impinged or entrained is not a measure of the significance of the impact. Rather, the losses must be evaluated relative to the sizes and productivity of the affected populations. The report concluded that, relative to the Lake Michigan fishery, the impacts of entrainment and impingement were inconsequential to aquatic life in Lake Michigan. The DNR concurred with that conclusion.

Figure 8-4 Existing cooling water intake structure



North Oak Creek units 3 and 4 were retired in 1988, and units 1 and 2 were retired in 1989. Therefore, as a result of the reduced intake flow rate, the minimal localized impacts associated with the eight-unit operation have been mitigated.

Existing thermal effect

Section 316(a) of the Clean Water Act requires thermal wastewater discharges to demonstrate and assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water where the point source is located. Dischargers of thermal wastes can be granted a less stringent alternate thermal effluent limitation if the discharger can satisfactorily show that the current effluent limitation, based on water quality standards, is more stringent than necessary.

Chapters NR 102, 104, and 209, Wis. Adm. Code, establish water quality standards, use designations, and procedures for the establishment of thermal effluent limitations for all surface waters of the state. The DNR has established a goal that water quality shall provide for the protection and propagation of fish, shellfish, and wildlife in all of the waters of the state. All surface waters classified for the support of “Great Lakes communities” of fish and aquatic life must meet water quality standards, including thermal standards, for protection of fish and aquatic life (s. NR 104.25).

Results of a 316(a) study completed by Oak Creek Power Plant (OCPP) in 1976 included a demonstration for the eight-unit operation, which concluded that the heated discharge had no significant environmental impact. At that time, the DNR found that the results of the OCPP study demonstrated that operation of the once-through condenser cooling system at OCPP did not preclude maintenance of a balanced, indigenous aquatic species population in the receiving waters of Lake Michigan at Oak Creek.

Results of the 1976 OCPP 316(a) study and several other 316(a) studies performed for large power plants on Lake Michigan in the late 1970’s indicated that no significant impacts on phytoplankton, zooplankton, and benthos were found. Localized responses of periphyton (*Cladophora*) sometimes occurred, but did not result in nuisance levels of algal growth. Localized influences on fish distribution were noted in and near the thermal plumes. However, it was concluded that operation of the power plants did not significantly affect fish populations in the general vicinity surrounding each facility, or in the far-field areas that were studied beyond thermal plume limits. These studies indicated that both the individual and the aggregate impacts of power plant cooling water discharges on the Lake Michigan ecosystem were insignificant, and were limited to localized shifts in fish distribution and periphyton growth in areas immediately associated with the thermal plumes.

The above-mentioned studies have consistently indicated a lack of significant impact of heated water discharges to Lake Michigan, and have found that localized influences are largely limited to slight changes in the areal distribution of resident fishes.

(*Source; North Oak Creek Power Plant 316(a) Demonstration Information Review, November 1992)

Biocides/additives

Currently, intake water is treated by an electrolytic dissolution system for zebra mussel control. This system releases dissolved copper and aluminum into the intake water, and has proven to be an effective molluscicide. Copper and aluminum concentrations have, and continue to be, monitored in the effluent. The concentrations have been below the DNR’s level of concern that would trigger effluent limitations. No other additives or biocides are used.

Existing water use

The existing OCPP units 5 - 8 have a maximum once-through cooling water flow rate of 1,165 mgd. The consumptive water losses for units 5 - 8 are:

Ash removal system losses	22,000 gallons per day
Coal unloading and pile spray	11,000 gallons per day
Demineralized water losses	15,000 gallons per day
Total:	48,000 gallons per day

Existing on-shore facilities

Existing discharge and storm water facilities

Operations that currently contribute wastewater which discharges from the cooling water outfalls without treatment include: condenser cooling water, unit 5 and 6 bottom ash hydrovactors, unit 5 and 6 fly ash hydrovactors backup system, condensate (from unit 5 and 6 drip tank and surge tank drain and overflow), roof drains, miscellaneous equipment non-contact cooling water, and the fire protection system.

The average flow from the four units combined total 977.6 mgd, with nearly 100 percent of the flow due to the condenser cooling water. The other contributors are low flows. The intake water flows through a trash rack and traveling screen to remove debris, and is subject to continuous molluscicide treatment as previously discussed.

Plant wastewater streams that require treatment prior to discharge are processed through a treatment system. Operations contributing process wastewater that discharge from the treatment system outfall include: low volume wastewaters (ash hopper overflows, unit 7 and 8 bottom ash transport systems, pyrite removal systems, miscellaneous equipment cooling water, floor drains, unit 5 and 6 bottom ash tertiary collectors, air compressor drains, fly ash sump overflows, air preheater washwater, boiler blowdown and drains, unit 7 and 8 surge tank drain and overflow, chemical storage area drains, and deionization regeneration wastewater), coal pile runoff (coal dock, upper reserve coal pile, car dumper floor drains, tower A and B roof and floor drains, coal tunnel sump, and lower junction tower wash down), nonchemical metal cleaning waste, light weight aggregate facility drainage, storm water (yard area runoff, unit 5 - 8 transformer bay drains) and ash landfill leachate.

The average flow is 3.4 mgd. The wastewater treatment system processes consist of:

- Bar screen
- Grit removal system
- Chemical precipitation by the addition of $FeCl_3$
- Sedimentation in two parallel basins of 1.7 and 1.8 million gallon capacity
- Sludge disposal at WEPCO landfill off site

Outfalls 006, 008, 009, and 010 are for emergency overflow when precipitation exceeds the 10-year 24-hour storm event. No monitoring of these outfalls is required. They are subject to the standard bypass requirements of the permit.

The permit regulates the intake water traveling screen washwater discharge at outfall 012. Flow monitoring is required. The backwash water consists of lake water, so any substances from this outfall (such as dead minnows or plant material) originate from the lake. The permit doesn't regulate the disposal of any accumulated substances.

Storm water discharges are regulated under the tier two general storm water permit issued to the OCPP.

Table 8-9 provides an overview and summary of the water discharge points and outfall locations for the existing OCPP facilities.

Table 8-9 Summary of the location and description of current OCPP outfalls (points of discharge to Lake Michigan):

Outfall/Sample Point Number	Location and Description
001	Alternate condenser cooling water outfall to recirculate effluent back into the water intake channel to prevent ice in the winter
003	Generator Unit 5 condenser cooling water, bottom ash hydrovactor, flyash hydrovactor backup, drip tank, surge tank drain & overflow, roof drains, miscellaneous equipment cooling water, and fire protection system
004	Generator Unit 6 condenser cooling water, bottom ash hydrovactor, flyash hydrovactor backup, drip tank, surge tank drain & overflow, roof drains, miscellaneous equipment cooling water, and fire protection system
005	Generator Unit 7 condenser cooling water, roof drains, miscellaneous equipment cooling water, and fire protection system
006	Generator Unit 8 condenser cooling water, roof drains, miscellaneous equipment cooling water, fire protection system, and wastewater treatment system pump station emergency overflow
007	Wastewater treatment system effluent Sources of wastewater: low volume wastewater, coal pile runoff, nonchemical metal cleaning waste, light weight aggregate facility drainage, storm water, and ash landfill leachate
008	Emergency overflow and north yard runoff
009	Emergency overflow from yard area around crusher house, surface drainage west of plant, and upper reserved coal pile runoff
010	Coal dock pump station emergency overflow
012	Water intake traveling screen backwash

Potable/sanitary water supply

The existing OCPP is supplied with potable and sanitary water from the city of Oak Creek.

On-shore water resources (WEPCO property)

Wetlands

There are 85 delineated wetlands within the project site that total about 83.2 acres (see Figures Vol. 2-12, 2-14, and 2-16). Most of these wetlands (76 of 85) are less than two acres in size and account for 33.5 acres. The remaining nine larger wetlands represent about 50 acres and the largest wetland on the property, a wet meadow/hardwood swamp, is more than 12 acres in size and is located along the western edge of the property.

Many types of wetlands can be identified within the WEPCO property, including shrub-carr, hardwood swamp, fresh (wet) meadow, shallow marsh, deep marsh and sedge meadow. Each wetland has different degrees of functional value in terms of floral diversity; fish and wildlife habitat; flood protection; water quality protection; shoreline protection; groundwater recharge and discharge; and aesthetics, recreation and education. Comparisons with Figures Vol. 2-13, 2-15, and 2-17, show that many of the larger wetlands are associated with Southeastern Wisconsin Regional Planning Commission (SWRPC) designated Primary Environmental Corridors (PECs), Critical Species Habitats (CSHs), and Isolated Natural Resource Areas (INRAs). These areas of biological concerns are discussed in more detail in Chapter 10. A number of the wetlands have been previously disturbed to some degree, by silitation or sedimentation from stormwater runoff, past filling, ditching, dredging, and impacts related to past agricultural land use.

North of Elm Road

Twenty-two wetlands have been identified within the project boundaries north of Elm Road. These wetlands range in size from 0.1 to 9 acres and typically consist of fresh (wet) meadow, shallow marsh, sedge meadow, shrub-carr, clay bluffs with spring seepages or wet to wet-mesic lowland hardwood forest. The plant communities in these wetlands were surveyed and no endangered, threatened, or special concern plant species were found. Of the total plants surveyed within these wetlands, 11 to 33 percent were non-native or alien species. All but seven of these wetlands are located within a SWRPC-designated PEC. Of note is a 6.1-acre wetland with high functional values including floral diversity and wildlife habitat. It is located just north of Elm Road, along Lake Michigan bluffs, extending some 1,600 feet inland. It contains spring seepages on eroding clay bluffs which support shallow marsh and fen-like plant assemblages, ranging from deep and shallow marsh to fresh (wet) meadow and secondary growth, southern wet to wet-mesic lowland hardwoods.

West of the railroad tracks

Twenty-nine wetlands have been identified within the property boundaries west of the railroad tracks and south of Elm Road. These wetlands range in size from 0.02 to 12 acres and typically consist of fresh (wet) meadow, shallow marsh, shrub-carr and wet to wet-mesic lowland hardwood forest. No endangered, threatened, or special concern plant species were found within the surveyed wetland plant communities. Non-native or alien species comprised 7 to 71 percent of the plant species within the wetland indicating a range of wetland quality in this part of the property. Fifteen of these wetlands are located either completely or partially within two INRAs. The largest wetland surveyed (12 acres) is located within this area.

East of the railroad tracks

Thirty-four wetlands have been identified within the property boundaries east of the railroad tracks and south of Elm Road. Three of the wetlands are larger than one acre, with the largest being 3.8 acres. The remaining wetlands are between 0.2 and 0.3 acres. The majority of the wetlands consist of fresh (wet) meadow and shallow marsh. The vegetation surveys for these wetlands did not identify any endangered, threatened, or special concern plant species. Twelve of these wetlands are located within areas of biological concern (PEC, INRA, and CSH).

Streams

Within and adjacent to WEPCO's property, there are also a number of existing waterways, most of which are unnamed tributaries to Lake Michigan. The DNR has conducted site investigations to determine the substrate and general habitat characteristics of the streams and have determined if the waterways met the criteria for navigability, under Wis. Stat. ch. 30. The site investigations have identified a total of eight creeks and tributaries, the majority of which are navigable at some location within the property boundary. Navigable streams range from 3 to 16 inches in depth and from 3 to 17 feet in width. The watershed for these tributary systems is primarily agricultural with some areas of residential, commercial, and industrial development.

Two streams are located north of Elm Road. The northernmost stream has a number of tributaries that drain portions of Bender Park. A large complex of wetlands is hydraulically connected with this stream located with a PEC. This stream was found to contain a good range of macroinvertebrate habitat due to the presence of gravel beds in the lower reaches. Habitat limitations include intermittent flow and shallow water depth. The other stream, located closer to Elm Road lacked defined riffle/run/pool structure, but may support seasonal use of available habitat by forage fish species and macroinvertebrates.

Another waterway located along the northwestern boundary of WEPCO's property is an unnamed tributary to the Root River. Within the property, the waterway has been severely impacted by past dredging, ditching, and runoff from the adjacent landfill. Silt is the predominant substrate in this stream, limiting the amount of suitable fish or macroinvertebrate habitat. The waterway flows southwest under STH 32, crosses the county line and converges with a larger tributary flowing northwest to the Root River.

The other streams on the property are located within the southern portion of the property. The main branch of this waterway emanates from a large wetland complex located southwest of WEPCO's property and west of STH 32. This branch of the stream flows northeast across STH 32 and the railroad corridor and onto the site near a horse farm on Seven Mile Road. The main branch of this stream and its tributaries flow through the Ravine Woods Natural Area (as defined by SWRPC) within one of the PECs (see Figure Vol. 2-14). It has a substrate of mixed sand and gravel upstream, with gravel/clay dominating in lower sections. Gravel beds, riffle/run structure are present throughout, resulting in good macroinvertebrate habitat. Steep gradients are present in the downstream sections as it flows into Lake Michigan. Although no fish were collected during the assessment, they may be present in the headwater wetlands off-site.

Railroad corridor

Wetlands

Although a few native prairie plant species are still present, the railroad corridor appears to be a highly disturbed area supporting many invasive and non-native species.[100] Vegetation along the corridor consists primarily of shrubs, prairie plants, and grasses in upland areas. Numerous intermittent drainage ways cross under the railroad through drainage culverts. Wetlands have developed in association with these drainage ways and the manmade ditches that parallel the track.

A total of 25 wetlands, totaling 11.0 acres, have been identified within the three-mile rail corridor. Most of these wetlands appear to be hydrologically connected to drainage ways and wetlands outside of the railroad corridor. The wetlands vary in size as well as community type. Community types include shallow marsh, fresh (wet) meadow, shrub carr, and sedge meadow. A majority of the wetlands are degraded and dominated by reed canary grass.

[100] In the Midwest, railroad corridors often harbor remnants of the native prairie communities that were once widespread in this area. This is because the rail corridors were never cultivated and experienced periodic burning caused by friction and sparks produced by the train wheels on the tracks.

Streams

Streams cross under the railroad corridor in five places, all of which are navigable at some location within the WEPCO property. Both Turtle Creek and an unnamed tributary to Lake Michigan are habitats sufficient to support a moderately diverse community of macroinvertebrates. In-stream plants are most likely limited to algae, bryophytes and cattails

New and Modified Off-shore Facilities and the Potential Impacts on Lake Resources

Water use

An overall water schematic for the ERGS is shown in Figure 8-5. This schematic integrates the two new SCPC units and the IGCC unit with the existing Oak Creek Power Plant. Currently, the OCPP takes in 1,015.3 mgd of water from Lake Michigan, and discharges 987.5 mgd.

As previously discussed, an off-shore intake would be constructed approximately 9,000 feet out into Lake Michigan. It is anticipated that the new intake would be operational at the same time that the first SCPC unit becomes operational; and that the existing units 5 - 8 of the OCPP would be tied into the new intake at that time. Ultimately, the three new units and the existing OCPP would be served by the new intake structure.

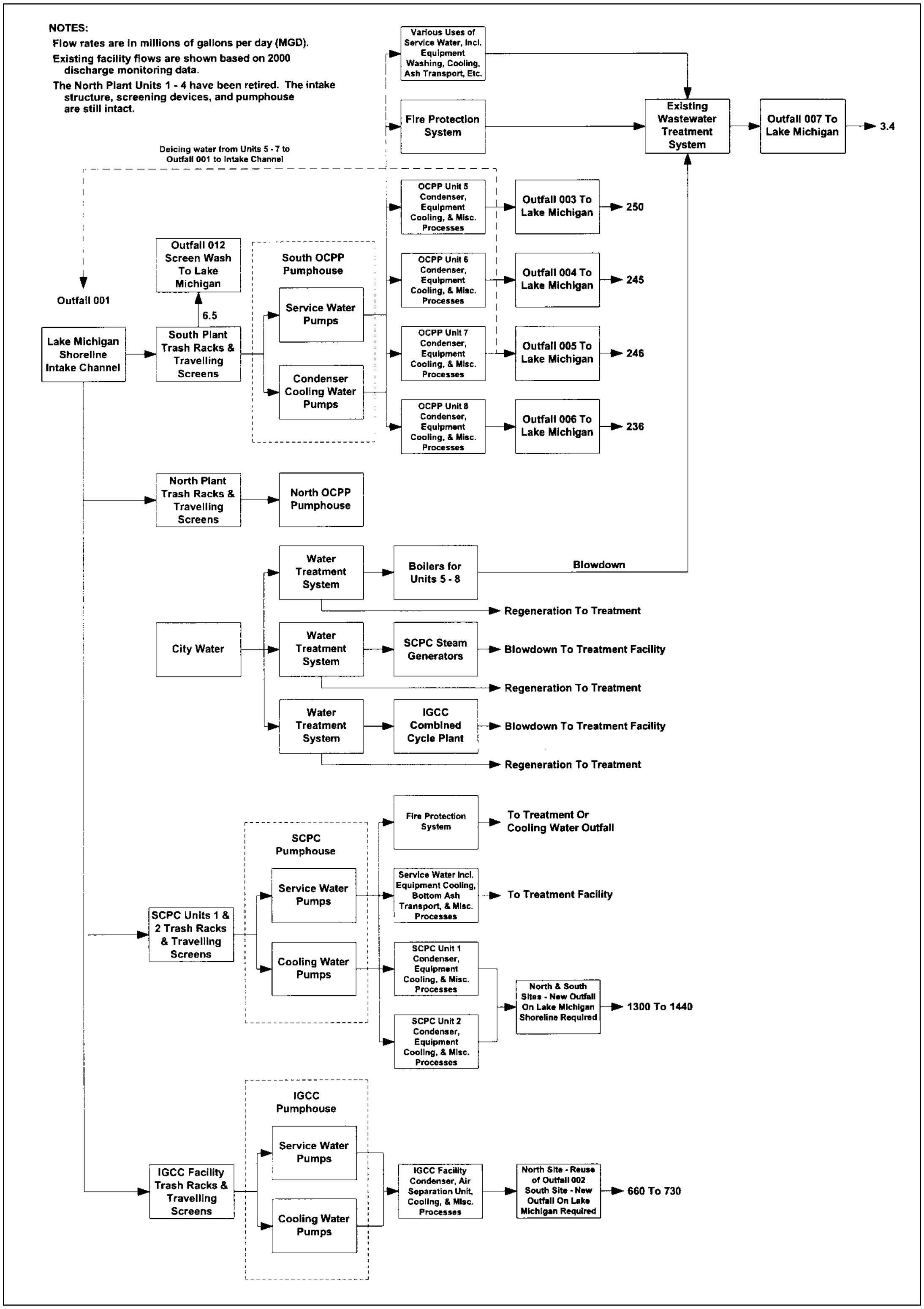
SCPC units

The first SCPC unit would withdraw about 700 mgd[101] of lake water at maximum loading. Added to current OCCP water demands, the combined withdrawal of lake water would be about 1,865 mgd. When operating, units 5 - 8 of the South OCPP and the first SCPC unit would "consume" lake water (i.e. use Lake Michigan water and not return it to the lake via a discharge outfall):

Ash removal system losses	184,000 gpd
Coal unloading and pile spray	18,500 gpd
Demineralizer water losses	101,700 gpd
Flue gas desulfurization losses	590,000gpd
Total	894,200 gpd

[101] 700 mgd is about 485,000 gallons per minute. This flow rate is a conservative estimate and the exact value would be determined during detailed design of the plant. The 2-01-02 CPCN Volume 3 submittal included a range of once through cooling water flow rates in Table 5 on page 46. The low end of the range is for anticipated rated load operations and the high end of the range is for maximum capacity operations.

Figure 8-5 Water flows for the entire ERGS and the existing OCPP



The second SCPC unit would withdraw an additional 700 mgd of lake water at maximum loading. Added to the first SCPC unit and the existing OCCP water demand, the combined withdrawal of lake water would be 2,565 mgd. All of these operations combined would consume lake water in the following quanitity:

Ash removal system losses	346,000 gpd
Coal unloading and pile spray	28,500 gpd
Demineralizer water losses	188,400 gpd
Flue gas desulfurization losses	1,160,000 gpd
Total	1,722,900 gpd

A full water balance diagram for the two SCPC units burning Pittsburgh #8 bituminous coal is shown in Figure 6-7.

IGCC unit

The IGCC unit would have a maximum cooling water flow rate (power block, air separation unit and process cooling) of about 700 mgd.[102] Added to the two SCPC units and the OCCP water demand, the combined withdrawal of lake water would be 3,265 mgd. The operations of the IGCC unit would "consume" lake water in the following amounts:

Slag removal system losses	615,000 gpd
Syngas process consumption	503,000 gpd
Demineralized water losses	108,000 gpd
Total	1,226,000 gpd

A full water balance diagram for the IGCC unit burning Pittsburgh #8 bituminous coal is shown in Figure 6-10. If the combined water loss of the existing South OCPP units and the first two SCPC units are added to this total, the cumulative water loss would be 2,948,900 gpd.

Cumulative use

The combined open-cycle cooling water demand in 2011 is estimated to be about 2,250,000 gpm and would be allocated as follows:

Existing OCPP units 5 - 8	(792,000 gpm)
Two SCPC plants	(970,000 gpm)
IGCC plant	(485,000 gpm)

A new pump house would be installed on the southwest side of the proposed SCPC facilities (on the North Site). OCPP units 5-8 would utilize the existing South plant pump house that would withdraw water from the planned forebay area that would enclose the western end of the intake channel. Both the forebay and

[102] This flow rate is a conservative estimate and the exact value would be determined during detailed design of the plant. The 2-01-02 CPCN Volume 3 submittal included a range of once through cooling water flow rates in Table 6 on page 48. The low end of the range is for anticipated rated load operations and the high end of the range is for maximum capacity operations.

new SCPC pump house locations would be connected to the proposed intake tunnel by means of a vertical dropshaft.

New circulating water pumps would be installed. These new pumps would have the capacity equal to the highest optimum flow for the seasonal range of lake temperatures, heat rejection rates, and desired discharge temperature. Cooling water would be piped to the main condensers of the first and second SCPC units via an underground large diameter piping system. Discharge water from the condensers for both proposed units also would be piped underground to the north side of the new dock extension and then east along the shoreline.

Cooling water intake structure

A combined cooling water intake supply is planned that would accommodate the needs of both existing OCPP units and the proposed three new units. The off-shore intake tunnel and structure and the on-shore pumping station and screening equipment are described in sections below.

Section 316(b) Clean Water Act

Section 316(b) of the Clean Water Act and Wis. Stat. § 283.31(6), requires that the location, design, construction and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impacts. A major goal of this regulation is to minimize the impingement and entrainment of fish and other aquatic organisms as they are drawn into a facility's cooling water intake. Impingement occurs when fish and other aquatic life are trapped against cooling water intake screens. Entrainment occurs when aquatic organisms, eggs and larvae are drawn into a cooling system, through the heat exchanger, and then pumped back out. Cooling water intake structures have the potential to cause adverse environmental impact by pulling large numbers of fish and shellfish or their eggs into the cooling system. There, the organisms may be killed or injured by heat, physical stress, or by chemicals used to clean the cooling system. Larger organisms may be killed or injured when they are trapped against screens at the front of an intake structure.

In December 2001, U.S. EPA published final regulations under s. 316(b) that established requirements that apply to the construction of intake structures for “new” facilities, as defined in that rule. Subsequently, in April 2002, U.S. EPA proposed regulatory language under the authority of s. 316(b) for **existing** power producing facilities that employ a cooling water intake structure and that withdraw 50 mgd or more of water from rivers, streams, lakes, reservoirs, estuaries, oceans, or other waters of the U.S. for cooling purposes [Federal Register: April 9, 2002 (Volume 67, Number 68)]. The proposed rule constitutes Phase II in EPA's development of section 316(b) regulations and would establish national requirements applicable to the location, design, construction, and capacity of cooling water intake structures at existing facilities.

According to the proposed rule language, a facility may choose one of three options for meeting best technology available requirements. These options include demonstrating that the facility currently meets specified performance standards; selecting and implementing design and construction technologies, operational measures, or restoration measures that meet specified performance standards; or demonstrating that the facility qualifies for a site-specific determination of best technology available because its costs of compliance would be significantly greater than the environmental benefits of compliance with the proposed performance standards. The proposed rule also provides that facilities may use restoration measures in addition to or in lieu of technology measures to meet performance standards or in establishing best technology available on a site-specific basis.

On November 22, 2002, EPA extended the deadlines for final action on regulations under section 316(b) of the Clean Water Act to minimize the adverse environmental impact of cooling water intake structures at existing facilities. Under the revised schedule, the new deadlines for Phase II regulations governing existing facilities include a final action date of February 16, 2004.

The DNR would require the new intake structure to meet BTA requirements proposed by U.S. EPA for "existing facilities" in the April 9, 2002 Federal Register. When the final regulations are published by U.S. EPA, those final regulations would be applied to this facility.

EPA delegation

On August 28, 2002, WEPCO requested that the U.S. EPA make a determination of applicability of regulations under s. 316(b) of the Clean Water Act for the Oak Creek Power Plant and the proposed Elm Road Generating Station (OCER). On October 30, 2002, G. Tracy Mehan, U.S. EPA Assistant Administrator for Water issued a letter to WEPCO indicating that the DNR, as part of the administration of the National Pollution Discharge Elimination System (NPDES) program in Wisconsin, would be responsible to make the s.316(b) determination for the ERGS facility.

DNR Determination

The DNR's January 28, 2003 determination is attached as Appendix C to this draft EIS. In summary, the Department has determined that the ERGS proposal, including the additional units and the currently proposed intake configuration, is not a "new facility" for purposes of implementing the requirements of 316(b) and associated regulations. The DNR's determination also indicates that the ERGS facility must meet BTA for minimizing adverse environmental impacts and that the performance standards to be used in designing an intake system must meet the BTA requirements proposed by U.S. EPA for "existing facilities" in the April 9, 2002 Federal Register. When final regulations are published by U.S. EPA, those final regulations will be applied to this facility.

Outcomes

At this time, U.S. EPA has not provided concurrence with the DNR determination that the proposed ERGS project is not a new facility in the context of the 316(b) regulations. However, U.S. EPA and the DNR do agree that the proposed offshore intake structure must be designed to minimize environmental impacts caused by impingement and entrainment of aquatic organisms. This is true for units that are currently operating at the existing power plant and also for the proposed new units. The proposed ERGS project and the modification of the cooling water intake is an opportunity to attain the BTA requirements. WEPCO has provided conceptual information about the cooling water intake and BTA. WEPCO will need to submit specific design information to the DNR during the WPDES permitting process to demonstrate how the BTA performance standards would be met. There may be changes (size, geometry, intake rate, etc.) to the conceptual cooling water design as specific information is reviewed during the DNR's WPDES permitting process.

WEPCO, DNR and U.S. EPA are in continuing discussions to determine the applicability of existing or proposed federal regulations to the proposed changes to this facility. A final determination of the applicable design criteria will be made prior to the issuance of the WPDES permit.

Description and location of proposed water intake system

The proposed water intake system is comprised of an intake structure and a water transport system that would move the water from the intake to the plant facility on the shore. The water intake system is designed to comply with s. 316(b) of the Clean Water Act and s. 283.31(6), Wis. Stats. The proposed design would pump the water from an offshore intake structure. The intake system would consist of four timber cribs through which water would be drawn. This water would then travel through a tunnel or a set of pipes to the screening facility onshore. The pipes or tunnel of the offshore portion of the intake system are proposed to extend into the lake approximately 9,000 feet. The final depth of the offshore intake crib would be about 43 feet. Photos of a typical timber intake crib can be found in Figure Vol. 2-10.

The dimensions and specifications of the forebay, screening facilities, pump houses, intake cribs or the velocity caps, would be the same regardless of the final intake length, depth or construction method. The existing intake channel would be modified as part of this project and would include the installation of a sheet pile wall to enclose 50,000 square feet of the existing intake channel (200 ft. wide by 250 ft. long). The enclosure of this portion of the intake channel would continue to be utilized for intake purposes. The remaining intake channel would be utilized for the mooring of barges.

Construction methods for the water intake transport system

WEPCO is currently investigating the construction of a tunnel below the lakebed that would move the water from the actual intake structure to the shoreline. The tunnel would be 32 feet in diameter and would be approximately 200 feet below the bed of the lake. The tunnel would be constructed by creating a construction shaft onshore and excavating down 200 feet. Tunneling equipment would then excavate a tunnel horizontally out to a 40-foot water depth. The design for the tunnel would require connection to four intake cribs that would each connect to a 14-foot diameter tunnel leading to a drop shaft that is 32 feet in diameter.

The total amount of dredging involved with this alternative would be approximately 10,000 cubic yards of unconsolidated material by clam shell bucket method. There would be an additional 400,000 cubic yards of rock excavated and removed from below the lake bottom via the onshore drop shaft. WEPCO conducted a geophysical investigation of the bedrock at this location and performed tests to determine if the bedrock was suitable for the construction of a tunnel. In addition, these tests would assist WEPCO in determining if the tunnel should be concrete lined to prevent leakage. The preliminary conclusions of the Geotechnical Data Report conducted by Montgomery Watson Harza and Associates dated November 2002 indicate that the bedrock is suitable for tunnel construction and would require minimal concrete lining. This method of construction would also require a permit under Chapter 30, Wis. Stats., in addition to compliance with NR 102, 346 and 347, Wis. Admin. Code.

For a 9,000-foot long intake tunnel, the approximate depth of soil and rock between the intake structure and the tunnel would be 60 feet and 68 feet respectively. The intake structure would be about 40 feet below the lake surface.

Potential impacts of construction of the water intake system

Construction of the intake structure would involve some degree of dredging regardless of which construction method is implemented. The alternative that WEPCO prefers, the construction of a tunnel in the bedrock, would have far less impacts on the bed and fewer temporary impacts on Lake Michigan. If the tunnel is constructed through the bedrock, the only areas of lakebed disturbance would be the areas where WEPCO would dredge for construction of the drop shafts. If the intake is constructed by dredging a trench and placement of four large pipes, the degree and extent of impacts to the bed and temporary construction impacts on Lake Michigan from dredging would increase significantly.

In general, mechanical dredging and placement of the intake structure on the bed of Lake Michigan would have a number of temporary impacts within that localized environment of Lake Michigan. These temporary impacts include local increases in turbidity within the water column, reductions in local dissolved oxygen levels, and reductions in local light penetration. The construction would temporarily disrupt the local fish population.

During construction it is expected that there would be 100 percent mortality of the benthic invertebrates within the construction zone. In addition, sediments suspended that eventually sink within the water column would likely impact some local benthic invertebrates which are in the vicinity of the construction site. Post-construction, it is likely that the benthic communities in these areas would re-establish. The dredging could also create an increase in local nutrient levels and could cause a local increase in planktonic growth. However, it is unlikely that the construction of the intake structure would increase the density of the existing zebra mussel population.

The long-term impacts of the intake structure include a modification to the bathymetry and could change the local fisheries populations and habitat adjacent to the project site. Many of these long-term impacts relate to the operation and possible maintenance of the intake structure which is discussed later in this section.

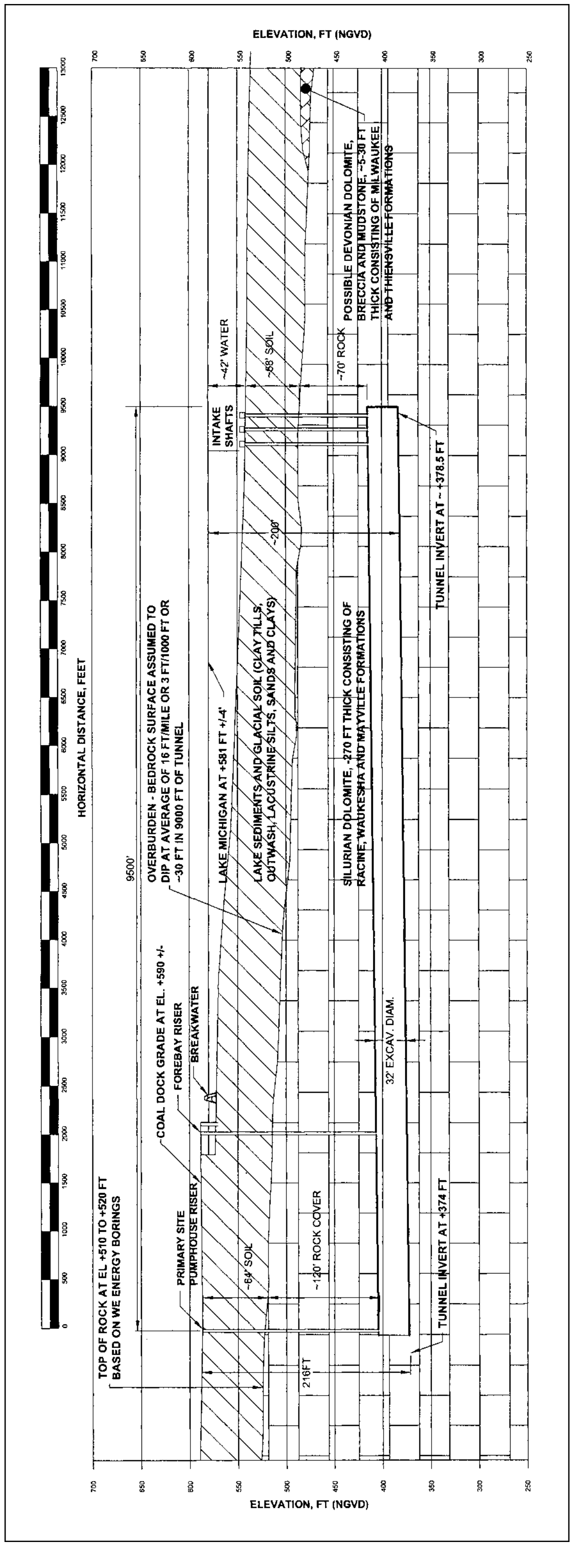
WEPCO is working with the DNR to determine the final location of the intake in order to minimize the intake structure impact on aquatic species. Measures such as silt curtains or turbidity barriers would be required to reduce the extent of the temporary impacts to Lake Michigan during construction.

Potential impacts of operation of the water intake structure

In February 2003, the applicants submitted a report, titled "Oak Creek Power Plant and Proposed Elm Road Station Cooling Water Intake and Lake Monitoring Study, February 2003." The report describes the results from the first year of a two-year program, which will be used to determine the abundance of fish eggs and larvae in the vicinity of the existing on-shore intake structure and the site of the proposed new off-shore intake structure. The data presented in this and the final report will be used to help establish location, design, and operational parameters for achieving compliance with the impingement and entrainment reduction criteria in the proposed EPA regulations for intake structures at existing facilities.

This report summarized data from icthyoplankton collections collected from June through September 2002, at transects near the present intake (in the intake channel and at an 18-ft depth contour) and the site of the new intake (30-35 ft contours at about 3,500 feet offshore and a 40 ft contour at about 9,000 feet offshore). The data clearly shows a marked reduction in total icthyoplankton densities at the 40 ft contour (the depth of the probable new intake structure site) in comparison to near-shore contours. Offsetting the benefit of reduced icthyoplankton density at the far-shore intake site is the fact that the cooling water demand would increase incrementally as new units are added to the intake.

Figure 8-6 Tunnel profile for a 9,000-foot long water intake pipe



The second phase of the study will involve near-shore and far-shore icthyoplankton collections from early May through September, 2003. Off-shore icthyoplankton sampling will be focused more precisely at the proposed intake location.

This February report gave calculated intake velocities at the present nearshore structure ranging from 0.5 to 1.8 ft/second (one to four pumps, respectively). The proposed design velocity at the entrance to the proposed offshore structure (whether consisting of intake cribs or velocity caps) is 1.0 ft/second; however, a velocity range of 0.5 ft/second to 1.0 ft/second is under consideration as detailed design for the caps or cribs is finalized. It should be noted that limiting intake velocity is not the sole factor in determining how best to design an intake structure to minimize adverse environmental impacts to fish and other aquatic life. If the velocity is reduced, there is a proportional increase in the intake area needed. This would require additional cribs or caps. Since the location selected is a sandy featureless area of the lake bottom, the potential impacts of adding more structure to the lake bottom must be weighed against the potential benefits of reducing the approach velocity.

Based on Electric Power Research Institute report,[103] a velocity of 1 ft/second has the potential to pull in salmon that are less than 10 cm in total length. This is based on EPRI's review of all published or otherwise available fish swim speed data. These data generally show that small (under 10 cm in length) salmon have sustainable swimming speeds that are less than 1 ft/second.

Small salmon greater than 10 cm in length size have swimming speeds that are typically greater than one ft/second. Thus, these larger fish should be able to avoid the currents surrounding the intake structure caps/cribs. Data are not available for trout, but the swimming speeds are expected to be similar to salmon. If fish enter the tunnel and reach the pumphouse, fish removal will occur at the traveling water screens. The traveling water screens for this project have not yet been selected, but there are designs and operations (low pressure and/or continuous screen wash) that can increase fish survival if impingement occurs.

Harbor construction activities

Description of proposed activities

As described in previous chapters, WEPCO proposes to increase the rate of coal delivery to fuel the new coal generating stations. Currently there are two alternative methods of coal delivery that are being considered by WEPCO. WEPCO's preferred alternative is to increase the rate of train delivery, which is discussed further in Chapters 10 and 12. A second option is to deliver the coal by ship. To allow for the navigational mooring of ships, WEPCO proposes to construct a harbor, which involves the expansion of the existing coal dock, construction of a breakwater and dredging of a navigational channel. Each element of the proposed harbor facilities plan is discussed in more detail below. See Figure Vol. 2-1 for an overview of the proposed harbor facilities.

[103] Technical Evaluation of the Utility of Intake Approach Velocity as an Indicator or Potential Adverse Environmental Impact under Clean Water Act Section 316(b). Electric Power Research Institute. Palo Alto, CA. Final Report, December, 2000. Report No. 1000731

Lakebed fill

Purpose, dimensions, and location

WEPCO proposes to place fill on the bed of Lake Michigan to expand the existing coal dock. The expansion of the dock would fill in an area of Lake Michigan immediately north of the existing dock. The dimensions of the fill would be approximately 340 feet wide and 900 feet long; the dock expansion would fill in approximately seven acres of Lake Michigan. This area would be utilized for the storage of coal, limestone and gypsum and would aid in the loading and off-loading of the barges or ships delivering materials to the site. The dock expansion would require approximately 200,000 cubic yards of fill material.

Construction methods and fill source (material characterization)

The preliminary plans for the dock expansion anticipate that the dock would be created by constructing a stone dike to enclose the reclamation area. The outside of the dike would be protected with a quarried stone revetment designed to protect the dock from wave action. The reclamation area would be filled with clean, granular materials to the water line. Above the water line, clean compacted fill would be used to provide an adequate working surface. The final construction of the dock expansion would be designed to prevent the loss of fill material into the lake, as well as provide hydraulic stability for the dock from coastal processes.

Breakwater

Purpose, dimensions, and location

WEPCO proposes to construct a breakwater to shield incoming ships and barges from large waves and to reduce the rate at which the proposed navigational channel would fill with fine-grained material carried by littoral processes. The preliminary plans for the proposed breakwater structure show that the breakwater may extend up to 1,900-ft. further into the lake than the existing coal dock and could be up to 150 feet wide. The proposed breakwater may fill an area of up to seven acres of Lake Michigan. WEPCO would undertake and submit additional studies to determine the optimal length, width and location prior to DNR permitting.

Construction methods and fill source

The construction of the breakwater would likely involve the construction of a rubble mound structure of quarried stone designed to withstand coastal processes and provide the desired protection to shipping traffic. The quarried stone would likely be obtained from an off-site source.

Navigational dredging

Purpose, dimension, and location

The required draft of a ship is typically 28 feet. Adjacent to the coal dock, the current water depth is approximately 10 feet from the Low Water Datum for Lake Michigan. WEPCO proposes to dredge a navigational channel and turning basin out to the 30 foot water depth to aid in the navigation of ships or barges. The creation of this navigational channel and turning basin would involve the dredging of approximately 900,000 cubic yards of material from the bed of Lake Michigan by means of a mechanical clamshell bucket. The navigational channel and turning basin would be approximately 2,300 feet long, 30 feet deep and range from 400 to 1,000 feet wide. Approximately 20 acres of lake bottom would be disturbed by the removal of 900,000 cu. yards of lake bottom material. The navigational channel widens to facilitate a turning basin near the coal dock. Under an existing permit, WEPCO conducts periodic maintenance dredging of a portion of this area that supports its existing navigation channel.

Material characterization of dredged material

A number of regulatory guidelines and regulations relate to the evaluation, characterization, and disposal of dredged materials. US EPA and US ACOE have developed a testing manual titled "Great Lakes Dredged Material Testing and Evaluation Manual," dated September, 1998. This manual is a refinement of the methods described in the joint EPA/US ACOE entitled Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual. Both of these publications describe a tiered decision making approach for evaluating the environmental impacts associated with dredging activities.

The National Oceanic and Atmospheric Administration (NOAA) has developed Screening Quick Reference Tables (SquiRTs, 1999) that are intended for preliminary toxicant screening of substances that are present in the area of concern. They are used as guidelines only, useful for identifying general levels of increasing toxicity to benthic organisms. The tables do not represent official NOAA policy.

Several state regulations including Wis. Admin. Code ch. NR149 and NR 219 establish standards, procedures, and registration criteria for laboratories conducting sediment testing. Wis. Admin. Code ch. NR 347 protects the public rights and interest in the waters of the state by specifying definitions, sediment sampling and analysis requirements, disposal criteria, and monitoring requirements for dredging projects.

The DNR Bureau of Watershed Management has prepared document WT-732-2002, titled "Consensus-Based Sediment Quality Guidelines - Recommendations for Use and Application" dated February, 2002. These guidelines are used to compare on-site sediment quality with consensus-based lower and upper effect values for contaminants of concern. These lower and upper effect values are based on the analyses of a large number of studies, investigating toxicological effects of contaminants on a wide range of organisms. These studies indicate chemical concentration levels below which minimal impacts to benthic macroinvertebrate communities may be expected, and concentrations above which there are probable impacts to benthic macroinvertebrates communities.

Results of sediment quality investigation

Within the proposed dredge area, two studies were completed to characterize the existing sediment quality. The first study was undertaken in 1998 as part of WEPCO sediment characterization study associated with its application to the DNR to dredge the existing intake channel and construct a breakwater on the lakebed. The second study was undertaken in 2002 by WEPCO to characterize the sediments within the proposed dredge area for the ERGS project. These results are discussed below.

1998 Sediment Investigation

Sediment sampling was undertaken by W.F. Baird & Associates, Ltd. of Madison, Wisconsin for WEPCO on December 29, 1998, within the existing intake channel. Four borings were taken with stainless steel boring equipment, then preserved and tested for contaminants.

The 1998 data indicate low to undetected amounts of chlorinated organic compounds such as PCBs and pesticides tested for within the project area. In most cases, reported levels were below the laboratory level of detection. Metals concentrations were at or below mean concentrations from other locations on Lake Michigan. (Cahill, 1981).

2002 Sediment Investigation

Sediment sampling was undertaken on November 4 and 5, 2002, within and adjacent to the proposed dredging area. Eleven split-spoon borings were taken, with samples then preserved and tested for contaminants. Sieve analysis was also performed on these samples. Full sediment analysis results are shown in Tables 8-8. A total of four borings were taken near the existing coal dock, six borings were taken in deeper water, and one boring was taken north of the existing plant, near the shore and potential cooling water outlet. Each boring was taken down to core material, plus two feet. In addition, boring extended through the bed material to the proposed dredge depth, plus two feet. Core material is defined as the clay layer expected to underlie the coarser depositional material. All bores were then separated into two-foot sections, with each section undergoing analysis. Sediment analysis was performed by Great Lakes Analytical, Buffalo Grove, Illinois.

Polychlorinated biphenyls (PCBs) are mixtures of individual chlorinated compounds, historically used as coolants and lubricants in electrical equipment such as transformers and capacitors. PCBs are known carcinogens, and bio-accumulate in the fatty tissue of mammals, birds, and fish. Currently, there is a WDNR issued fish consumption advisory for salmon, trout, perch, whitefish, chubs, smelt, and carp caught from Lake Michigan due to elevated PCB levels.

The 2002 sampling protocol required sampling for PCBs in two locations adjacent to the existing coal dock within the dredge area. The sampling coverage was limited, due to knowledge of likely areas of PCB deposition and the negative results of previous sampling within the immediate area. No PCBs were detected in this sampling effort.

Metals are present naturally in the sediment of Lake Michigan**,** so trace levels of metals were detected at all sample sites. The levels of trace metals found at all boring locations are close to or below the mean individual metal concentrations of sediments taken from other locations on Lake Michigan (Cahill, 1981). Based on toxicant screening with SquiRT and CBSQG tables, and the naturally occurring background concentrations of metals in Lake Michigan, the trace metals present on site do not present a risk to aquatic organisms.

Polycyclic aromatic hydrocarbons (PAHs) are 2-7 ring cyclic hydrocarbon compounds. These compounds are associated with oil, coal, forest fires, cigarette smoke, and municipal waste streams, among others. Of the eleven locations sampled, PAHs were detected at three of them, specifically sites within the intake channel and near the southeastern corner of the existing coal dock. It is reasonable to expect that the concentration levels of certain PAHs detected near the sampling areas are at high enough levels to negatively effect nearby resident benthic macroinvertebrate populations. It is likely that the PAHs are associated with the nearby coal dock.

Organochlorides are pesticides historically used to control insects. These substances include DDT (and it's breakdown products DDE and DDD), Endrin, and Chlordane, among others. Sampling for organochlorides was not undertaken due to previous negative results within the sample area.

Excavation methods

The common dredging methods are mechanical dredging, hydraulic dredging, or a combination of the two. Within any given method, there are many variations of approaches and equipment type that will affect the efficiency of the excavation and the effects on the waterbody. Dredging techniques and methods can be specifically tailored to meet the needs of a particular site and manage the risk associated with disturbance of the bottom sediment and impacts on habitat. Further decisions on specific dredging techniques would be reached prior to obtaining a ch. 30 dredging permit.

Disposal of dredged material and fill sources

Four methods of dredge material disposal are possible. These options are: landfilling the dredge spoils on WEPCO property, landfilling off-site in a licensed landfill, using the spoils on-site as construction fill, and using the spoils as beach nourishment. The ultimate disposal options would be decided on prior to obtaining a ch. 30 dredging permit and an exemption from the Solid Waste section. It is estimated that a combination of these disposal options would be applicable, depending upon sediment characterization done under recent and future sediment sampling activities.

Potential impacts of harbor construction activities

Dredging of the lake bottom to 30 feet below Low Water Datum, the depth necessary to accommodate lake freighter drafts of 28 feet, would take place east of the coal dock. The dredge area ranges from 400 to 1,000 feet wide, and extends approximately 2,300 feet out into the lake, to approximately the 30-foot contour. Approximately 35 acres of lake bottom would be disturbed by the removal of 890,000 cubic yards of lake bottom material.

Coastal processes impacts

The Coastal Analyses Report prepared by Baird & Associates for WEPCO states that the proposed harbor would block the extimated 3,000 m^3 of material which currently bypasses the OCPP site on a yearly basis. The report concludes that existing structures within this littoral cell, such as the existing coal dock at the OCPP facility, have had significant impacts on littoral drift since their construction and are likely one of the factors that has contributed to shoreline erosion south of the existing coal dock.

Baird's analysis concludes that the small amount of very fine littoral material, which is currently bypassing the site, would not provide adequate protection to the shoreline south of the exitsing power plant and the complete interruption of this littoral drift from the construction of the harbor, would not cause significant impacts on downdrift properties. The construction of the harbor would cause some minor changes to local circulation patterns and may cause some changes to wave characteristics adjacent to the site due to changes in bathymetry, fetch and wave refraction or reflection off of the proosed structures.

Physical impacts

The creation of the harbor would impact the local bathymetry, and create dramatic changes in gradient between the coal dock, breakwater and navigational channel. Additionally, the diverse benthic habitat within the harbor area would be reduced from a mixture of micro-habitat areas to a uniform zone of sand and silt or large rock riprap from the breakwater and dock. During construction of the harbor, especially during dredging operations, sediment sorting will occur, with larger heavier particles such as boulders, cobble, and gravel settling first, followed by a blanket of sand, muck, and silt. The dredged area would then slowly fill in with sand from seasonal variations in long-shore sediment transport or slumping of the channel boundaries. Periodic dredging of this area would be needed to maintain adequate draft depth.

Figure 8-7 DNR sediment sampling table – Part 1

ug/g = ppm = mg/kg
ng/g = ppb = ug/kg
all values reported as dry weight

Core / Parameter	Units	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6A	B6B	B7	C1	C2	D1	D2	D3	D4
		0-2 ft.	2-4 ft.	4-6 ft.	6-8 ft.	0-2 ft.	2-4 ft.	4-6 ft.	6-8 ft.	8-10 ft.	10-11 ft.	11-12 ft.	12-14 ft.	0-2 ft.	2-4 ft.	0-2 ft.	2-4 ft.	4-6 ft.	6-8 ft.
TOC	ug/g	2860	654	991	2650	953	557	1570	721	1500	1940	2860	2890	918	2820	1080	694	1040	2660
PAHs																			
Acenapthene	ug/kg			181	879					156									
Acenaphthylene	ug/kg							1330											
Anthracene	ug/kg																		
Fluorene	ug/kg																		
Napthalene	ug/kg																		
2-Methylnapthalene	ug/kg			138	132														
Phenanthrene	ug/kg			183	115														
Benzo(a)anthracene	ug/kg		73.8	87.5															
Benzo(a)pyrene	ug/kg	22.8	96.8	109	42.9			13.1	7.46	14.5	9.48		5.22	5.72		8.77		13.5	
Benzo(b)fluoranthene	ug/kg		78	87.6															
Benzo(k)fluoranthene	ug/kg																		
Benzo(g,h,i)perylene	ug/kg			103	166														
Chrysene	ug/kg			107															
Dibenz(a,h)anthracene	ug/kg		13.8	13.4	39.5						10.3		6.89						
Fluoranthene	ug/kg			225															
Indeno(1,2,3-c,d)pyrene	ug/kg		67	72.9															
Pyrene	ug/kg		139	234															
Particle Size																			
gravel	%														3.2			0.5	
sand	%	76.3	71	37.8	3	84.5	78.9	44.5	6.6	13.4	63	8.8	9.1	28.4	13.3	78.9	90.3	93.8	53.5
silt	%	23.7	29	62.2	97	15.5	21.1		93.4	86.6	36.7			71.6		21.1	9.7	5.7	46.5
clay	%							55.5				91.2	90.9		83.5				
METALS																			
Aluminum	mg/kg	1740	1800	2440	9380	1670	1520	1230	1260	1770	1210	7570	7770	1260	6720	911	1110	1740	3270
Arsenic	mg/kg																		
Barium	mg/kg				46.9							35.3	36.9		35.1				
Cadmium	mg/kg																		
Chromium	mg/kg	5.04	8.51	20.7	15.4	4.02	4.63	3.8	6.09	11.4	16.3	10.4	10.5	4.87	9.52	2.85	3.82	3.03	6
Copper	mg/kg	10.3	11	14	17.4	8.22	7.81	9.7	9.9	9.83	7.25	12.8	15.3	6.1	12.2	6.37	7.66	5.08	6.77
Cyanide	mg/kg																		
Iron	mg/kg	5,530	5,360	7,770	15,600	5,180	5,160	5,790	6,090	5,890	4,360	14,100	4,090	5,490	12,100	4,220	4,990	9,960	7,540
Lead	mg/kg	6.76	10.2	11.9	5.19	3.69	4.56	6.99	5.88	9.42	4.96	4.96	5.08	4.88	4.49	3.83	6.09	2.79	4.06
Manganese	mg/kg	214	200	303	301	181	205	202	232	258	153	349	373	206	300	193	170	782	222
Mercury	mg/kg		0.0548	0.0748					0.0426	0.0669						0.0752			
Nickel	mg/kg	5.09	6.17	6.98	15.9	3.57	3.39	3.65	4	4.65	3.4	14.6	15	3.66	13.3		3.63	4.43	7.03
Selinium	mg/kg																		
Zinc	mg/kg	31.5	36.7	33.8	25.8	30.3		39.2	45.4	32.2	39.8	25.8		39		28.1	37.9		44
Sulfate as SO4	mg/kg																		53.7

NO DETECT
NOT TESTED

For complete analysis results, refer to Elm Road Generating Station - Application for Water Regulatory Permits and Approvals, Additional Information. December, 2002.

Figure 8-7 DNR sediment sampling table – Part 2

ug/g = ppm = mg/kg
ng/g = ppb = ug/kg
all values reported as dry weight

Core	Units	E1A	E1B	E2	F1A	F1B	F2	G1	G2	H1	I1	I2	I3	J1	J2	J3	J4	J5A	J5B	J6	J7	K1	K1B
Parameter	Units	0-1.5 ft.	1.5 - 2 ft	2 - 4 ft.	0 - 2 ft.	.2" - 2 ft.	2 - 4 ft.	0-2 ft.	2 - 4 ft.	0-2 ft.	0-2 ft.	7-8.5 ft.	9-11 ft.	0-2 ft.	2-4 ft.	4-6 ft.	6-8 ft.	8-10 ft.	8-10 ft.	10-12 ft.	21-23 ft.	0-2 ft.	1.4 - 2 ft.
TOC	ug/g	1200	3160	2940	514	2710	3220	2040	3100	3680	587	678	3820	696	1030	3900	1050	501	3760	3530	2640	547	2050
PAHs																							
Acenapthene	ug/kg				see F1B																		see K1
Acenaphthylene	ug/kg													228						207			
Anthracene	ug/kg																						
Fluorene	ug/kg																						
Napthalene	ug/kg																			136			
2-Methylnapthalene	ug/kg																			1160			
Phenanthrene	ug/kg																			127			
Benzo(a)anthracene	ug/kg															51.9							
Benzo(a)pyrene	ug/kg	15.5									8.66			9.03	12.1	48.8	6.96	12.9		15.2			
Benzo(b)fluoranthene	ug/kg															54.1							
Benzo(k)fluoranthene	ug/kg																						
Benzo(g,h,i)perylene	ug/kg																			143			
Chrysene	ug/kg															143							
Dibenz(a,h)anthracene	ug/kg														9.22	30.6				51.3			
Fluoranthene	ug/kg															121							
Indeno(1,2,3-c,d)pyrene	ug/kg																						
Pyrene	ug/kg																			262			
Particle Size																							
% gravel			0.5	1.5	see F1B	2.5	0.8			24.1			3			0.2			1.8	1		0.3	
% sand		90.4	9.8	7.8		11.6	10.6	2.6	13	21.3	94.7	90.7	7.9	82.4	85.7	86.5	90.9	96.2	6.2	34.8	0.7	78	0.9
% silt		9.6									5.3	9.3	89.1	17.6	14.3	13.3	8.9	3.5				20.9	
% clay			89.7	90.7		85.9	88.6	97.4	79	54.6									92	64.2	99.3		99.1
METALS																							
Aluminum	mg/kg	1460	6490	7310	1040	9020	7110	2610	6260	7230	878	1140	7250	1060	1340	1770	1080	1090	5270	4820	6830	3590	see K1
Arsenic	mg/kg																						
Barium	mg/kg		33.4			44.2	32.6		33	38.7			37.2						25.1	30.1	30.5		
Cadmium	mg/kg																						
Chromium	mg/kg	6.28	9.25	10.5	2.07	13.4	10.2	3.25	8.85	10.4	3.69	10.9	10.8	3.17	3.53	4.66	3.68	4.05	7.26	9.03	9.18	3.89	5.04
Copper	mg/kg	9.06	11.5	13.1	2.57	13.4	11.5	10.6	11.5	12.3	8.07	8.47	13.7	4.93	6.49	8.07	5.61	7.63	12.8	21.1	12.3	4.24	9.48
Cyanide	mg/kg																						
Iron	mg/kg	5,150	12,400	13,800	16,800	14,700	13,500	9,650	12,700	13,300	5,380	5,760	13,100	4,640	4,800	5,650	5,100	5,560	12,800	10,300	13,300	5,390	10,900
Lead	mg/kg	6.59	7.32	4.71	5.41	5.43	5.7	4.72	4.92	4.77	4.35	12.3	5.09	3.91	5.02	6.3	6.83	6.64	5.52	12.1	4.77	4.27	4.71
Manganese	mg/kg	178	371	329	697	297	338	395	365	327	181	232	336	162	174	196	180	173	378	220	311	141	352
Mercury	mg/kg	0.319										0.0666								0.0811			
Nickel	mg/kg	4.62	13.2	14.8	4.42	17.8	14.8	8.25	13.6	14.4	2.94	4.26	15.8	2.99	3.62	4.33	3.83	5.51	12.1	10.9	13.3	2.91	10.2
Selinium	mg/kg																						
Zinc	mg/kg	36.4	28.9			28.4				74.3	71.7	41.6		28.5			27.4	56.7		32		26	
Sulfate as SO4	mg/kg																						

NO DETECT
NOT TESTED

For complete analysis results, refer to Elm Road Generating Station - Application for Water Regulatory Permits and Approvals, Additional Information. December, 2002.

Turbidity within the water column would increase within and adjacent to the dredged area and may result in local temperature increases and diminished light penetration. The creation of the breakwater and dock expansion would eliminate the habitat that once existed in those areas.

Chemical Impacts

Nutrient loadings of phosphorus may increase in and near the project area, as sediments and settled detritus are disturbed by dredging. These released nutrients may increase planktonic growth on a local scale, but larger scale blooms due to dredging activities would not be expected.

Oxygen demand within and adjacent to the project area may temporarily increase as sediments are disturbed and re-deposited. No impacts to aquatic organisms would be expected, due to the large mixing zone.

Biotic Impacts

Benthic invertebrates

Currently, the project area may be assumed to have four types of bottom habitat. They are: rock and boulder fields, mixed cobble/gravel/sand bottoms, hard clay outcrops, and sand/silty bottoms. This assumption is based on characterization of the lakebed further east of the proposed dredge area, undertaken by the Great Lakes Water Institute. Their findings are published in Great Lakes Water Institute Technical Report 2003-1. The dredging would impact benthic invertebrates within the project area by direct removal of the organisms, and removal of their habitat. One hundred percent mortality could be expected. Post-dredging, macroinvertebrate communities would reestablish within the dredged area. However, the community diversity would be reduced, reflecting the transition from rock/boulder/sand substrate to a monotypic sand substrate. Zebra mussel densities within the project area would be expected to be reduced after dredging due to removal of hard substrate.

Benthic communities adjacent to the dredge area would also be temporarily impacted due to burial by settling of sediments suspended into the water column by dredging activities. These communities would re-establish via expansion from surrounding macro-invertebrate populations.

Fish

The fish community within the dredge area would be temporarily impacted due to disturbance from dredging operations. Additionally, more severe, longer-term impacts to the bottom dwelling fish in the dredge area would occur. This would be due to habitat removal of species associated with rocks and boulders, including sculpins, Johnny darters, yellow perch, and lake trout

Rooted aquatic plants and algae

Lakebed surveys within the project area were undertaken in 2002 by the Great Lakes WATER Institute. Those studies show no aquatic macrophytes within the project area. Most of the project area is in water depths deeper than the maximum rooting depth of macrophytes (Eurasian Watermilfoil, Coontail, and Elodea) commonly found in Lake Michigan. Those areas that are shallow enough to support macrophytic growth are subject to long-shore drift and high-energy wave action. There is an existing peripyton community, dominated by the green algae Cladophora. The periphyton community would be impacted directly by physical removal. Limited recolonization of the dredge area would occur where suitable hard substrate is available.

Toxicity to water column organisms

Sediments within the project area have the potential to release certain toxicants to the surrounding water column during dredging activities. Organisms that cannot avoid the dredge area, such as zooplankton and phytoplankton, may potentially be exposed to these contaminants. However, these polar compounds are strongly attracted to particulates, and those compounds freed into the water column would be expected to rapidly rebind with suspended sediment and settle out of the water column, removing the risk of chronic exposure to water column organisms. Likewise, freed PAH contaminants would also not be expected to significantly impact water column organisms due to dilution, particulate attraction, and by comparing sediment concentrations to effect concentrations.

Drinking water impacts

South Milwaukee and Oak Creek Water Utilities have drinking water intakes located on the bed of Lake Michigan. These locations are northwest of the proposed dredging area. Depending upon the drift of sediment suspended by dredging activities, there is a slight risk of impacts to these utilities. Due to water treatment processes, no serious problems with drinking water quality would be expected to occur. However, to minimize risk, it is advised that WEPCO notify these facilities prior to initiating dredging activities.

Other impacts

The natural scenic beauty and aesthetic enjoyment (both visual and auditory) of Lake Michigan in the project area would be temporarily affected by the presence of construction equipment, as well as decreased local water quality during construction operations. The project area is located in an area associated with heavy recreational boating and fishing. Dredging would temporarily interfere with navigation within the project area and the overall harbor construction may permanently alter recreational navigation within this local area due to the increase in ship and barge traffic and changes in navigational patterns.

New and Modified On-shore Facilities and Potential Impacts on Wetlands and Streams

Impacts of new facilities

A majority of the wetland impacts would occur through the placement of fill for the proposed soil stockpiles. As discussed in Chapters 10 and 11, WEPCO proposes to excavate a maximum of five to ten million cubic yards of soil, which would be used on-site for berms and grading. The impacts to the wetlands would vary depending upon the different siting alternatives. WEPCO has identified the locations for the placement of the excavated soil for each of the site alternatives proposed in its CPCN application (see Figures Vol. 2-1, 2-2, and 2-3). Table 8-10 shows the acres of wetland impacts for the proposed alternatives. Regardless of the alternative chosen, four of the eight larger wetlands (two acres or more in size), would not be filled in. The remaining four larger wetlands would be reduced in size by at least 12 to 20 percent depending upon the alternative.

The wetland and stream impacts described here for the North Site are for the original site layout in the CPCN application. Wetland and stream impacts related to the CUP Option site layout are discussed in Chapter 12.

Table 8-10 Acres of wetland filled for proposed alternatives

	Estimated wetland acres filled	Percentage of wetland acres filled
North Site	18.78	22.5
South Site	15.84	19.0
South Site-Exp	15.19	18.2

The proposed alterations to the site would result in a major change to the site topography and hydrology including water quality and amount of stormwater runoff. A number of wetlands would be filled completely and many of the remaining wetlands would either be partially filled or would experience secondary impacts as a result of the construction. Wetlands that would be completely filled in include the high-quality 6.1 acre wetland located due north of Elm Road. Secondary impacts would include changes to the area's hydrology, impacts to water quality, wildlife habitat, and the introduction or encouragement of the proliferation of non-native invasive species.

Currently most of the wetland acreage on the property is dominated by native non-invasive species. Included in the mix of wetland types are some high-quality wetlands in terms of their functional values. Comparing WEPCO's proposed construction plans to the location of delineated wetlands shows that many of these high-quality wetlands would be either partially filled in or directly adjacent to berms with a constructed height of 50 or more feet. Wetlands adjacent to these new topographic features would most likely be impacted by sediment-laden stormwater runoff and erosion. These impacts would result in changes to the size, type, and quality of the wetlands.

The placement of fill in a wetland requires a Water Quality Certification from the DNR under s. 281.22 and s. 281.37, Wis. Stats. and NR 299, Wis. Adm. Code. Applicants must comply with NR 103, Wis. Adm. Code which requires the applicant to submit a Practicable Alternatives Analysis that evaluates alternatives which would avoid or minimize wetland impacts taking into consideration cost, available technology and logistics in light of the overall project's purpose. The DNR will make a determination whether WEPCO has shown that no practicable alternative exists that would avoid or minimize impacts to the wetlands and whether the activities would result in significant adverse impacts on wetland functional values. DNR staff would work with WEPCO during the permitting process to evaluate the functional values of all wetlands and would encourage WEPCO to avoid or minimize the wetland impacts where practicably possible.

Treatment and discharge of cooling water

Description and location of proposed water discharge structure

The proposed discharge structure would provide control for the discharge of non-contact cooling water. The structure would involve the construction of a seal well structure with concrete retaining walls and a rock-lined dredged channel. The rock lined channel would control erosion and reduce the velocity of the discharged water. The channel would be approximately 200 feet wide and would extend approximately 750 feet into the lake. To create the discharge channel approximately 10,000 to 15,000 cubic yards of material would need to be dredged from the bed of Lake Michigan.

The final design and location of this structure could be modified depending upon whether the North Site or South Site is the final location of the proposed SCPC and IGCC units. There could also be changes to the discharge structure that reflect requirements of state or federal regulations relating to the flow regime, erosion control and energy dissipation.

Storm water drainage from common areas of the property and the coal pile runoff would be handled by a common treatment facility shared with all the proposed ERGS units.

Site differences

The proposed discharge structure for the North Site would be located north of the existing coal dock (see Figure Vol. 2-1). The shoreline at this location is characterized as a wide sand beach, which provides good aquatic habitat, and habitat for various shore species.

If the ERGS facilities are built on the South Site or the South Site-Exp the discharge structure would be located south of the existing coal dock directly east of the facility along the Lake Michigan shoreline. At this location the shoreline has been modified with the placement of sheet pile and riprap. The water is much deeper at this location in comparison to the northern location and at this location the proposed discharge would be in the vicinity of the existing discharge structure (see Figures Vol. 2-2 or 2-3).

Description of construction methods for the water discharge structure

It is anticipated that the discharge structure would be constructed by initially creating the seal well structure with concrete wing walls and the necessary utilities for operation. WEPCO would then mechanically dredge the discharge channel from either the nearshore area or from a barge. Rock riprap would then be placed in the discharge channel. Final construction methods would be discussed during the permitting process and construction would occur in a manner that meets State Statutes and Administrative Code.

Potential impacts of construction of the water discharge structure

The impacts to Lake Michigan from the construction of the discharge structure include temporary impacts such as local increases in turbidity within the water column, reductions in local dissolved oxygen levels, and the reductions in local light penetration. The construction of the discharge structure would also temporarily disrupt and possibly destroy the local flora, fauna and aquatic habitat, including fish. Measures such as silt curtains or turbidity barriers would be required to reduce the extent of these temporary impacts. The long-term effects of the placement and operation of the discharge structure include a loss or modification to the existing aquatic and nearshore habitat in the area, and changes to local water quality. If the discharge structure is placed north of the existing coal dock the presence of the discharge structure may disrupt local wildlife species which utilize the sand beach in this area and would likely require more frequent maintenance dredging of the discharge channel due to littoral drift in this area.

Potential impacts of operation of the water discharge structure

The anticipated maximum flow through rate for each SCPC unit and the IGCC is 485,000 gpm with a temperature rise of 12 °F. The maximum heat rejection rate for the three units combined would be 8,740 million BTU/h.

The primary effluent from the OCPP is once-through cooling water from the steam condensers. No chemicals are added to the water; therefore, temperature is the only water quality parameter significantly affected by the discharge of cooling water. Heated effluent from the two proposed SCPC units would be discharged north of the coal dock through either a single or combined outfall structure. Heated effluent from the IGCC facility would be discharged through a single new outfall structure or combined with the SCPC outfall.

The DNR has proposed new water quality criteria that would apply to thermal discharges from steam electric power plants. Specific acute and sub-lethal temperature criteria have been developed for Lake Michigan that are a function of the 90^{th} percentile monthly ambient lake temperature (proposed NR 102.24, 102.25). The acute temperature criteria are used to calculate end-of-pipe limits, expressed as a "daily maximum temperature" limitation in a wastewater discharge permit. The sub-lethal criteria are used to calculate limits at the edge of the mixing zone, expressed as an "average temperature" limitation. The averaging period has not yet been established, but will likely be a three-day, seven-day, or monthly average.

The equation for calculating effluent limitations is:

$$\textbf{Limitation} = [(WQC - T_b)/e^{-a}] + T_b$$

where: WQC is the water quality criterion,
T_b is the background temperature, and

$$a = [A \cdot (54.7 + (B \cdot 150))]/[8{,}360{,}000 \cdot Q_e]$$

where: A is the allowable surface area of the mixing zone,
B is the heat loss coefficient, and
Q_e is the effluent flow rate.

Based on the anticipated maximum flow rate of 700 MGD for each of the three new units, the temperature rise of 12^0F above the ambient lake temperature, and the default mixing zone area of 3,125,000 ft^2 for an onshore discharge, the combined discharge of the three units would exceed the calculated daily maximum temperature limit for the months of July, August, and September (refer to figure 8-7). The discharge would also exceed the calculated average temperature limit for the months of May through November (refer to figure 8-8). Providing a separate cooling water outfall structure for the IGCC unit would still result in daily maximum and average temperature limitations exceedences for the months indicated above; and the excedences would occur for both the IGCC outfall and the combined SCPC outfall.

The formula (shown above) for calculating temperature limitations is very conservative because only heat loss to the atmosphere is considered. Heat loss caused by entrainment and mixing of receiving water is not included. The proposed regulations, however, allow for other scientifically defensible methods of calculating effluent limitations (proposed NR 106.24(6)).

WEPCO and its consultants are developing thermal models of the proposed discharge to include the effect of mixing due to naturally-occurring near-shore currents. EPA's CORMIX model will be used for the near-field region. The MIKE 21 2-dimensional hydrodynamics model, developed by the Danish Hydrologic Institute, will be used for the far-field region. Output from EPA's GLERL existing model of Lake Michigan currents will be used as input to both the CORMIX and MIKE 21 models.

Modeling results could be used either to demonstrate that calculated temperature limits can be met within the default mixing zone or, alternatively, to support a request for alternative temperature limits through a 316(a) demonstration.

Figure 8-8 Calculated daily maximum temperature limits (acute temperature criteria)

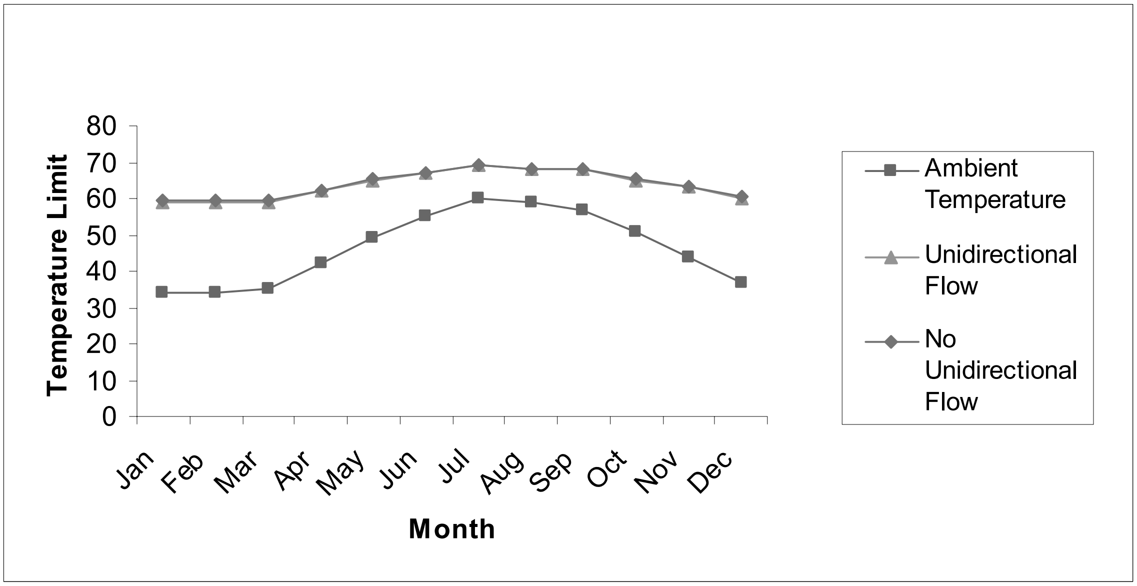
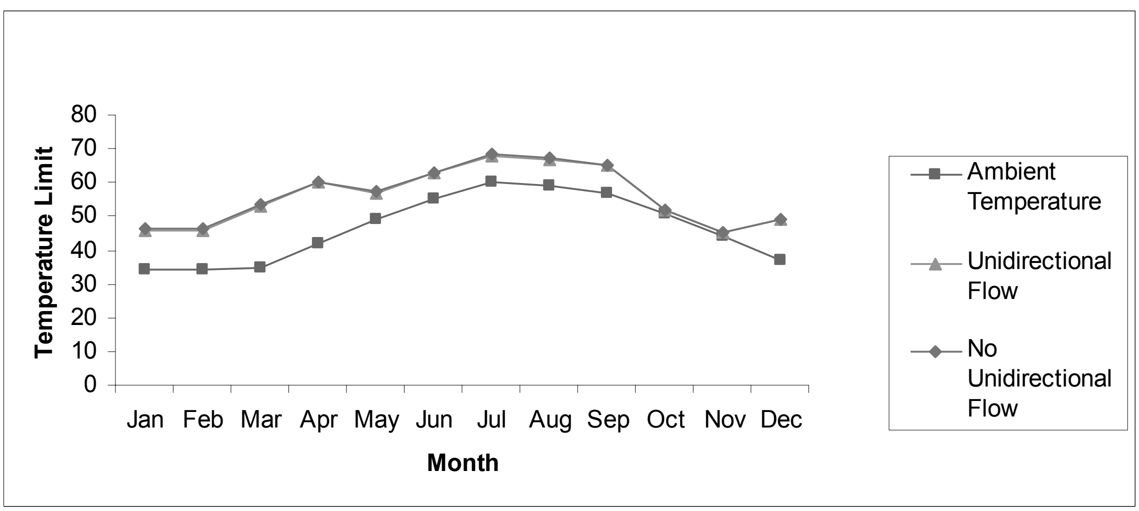


Figure 8-9 Calculated average temperature limit (sub-lethal temperature criteria)



Zebra mussel control

At the lake bottom intake structure, the only option for zebra mussel control would be manual cleaning by divers. The intake drop shafts and tunnels should not have significant zebra mussel accumulations because velocities would be too high (over six feet per second) for mussel settlement to occur.

Pump house wet wells, frames for the traveling water screens, pump bell housings and other on-shore equipment would also need to be periodically manually cleaned. Plant service water would be treated using the copper ion generator that has been successfully used at the existing OCPP units 5 - 8. This device involves the electrolytic dissolution of a low level of copper ions and also releases an aluminum floc. Parts-per-billion levels of copper cause the mussels to be agitated and the inside of the plant water system becomes less habitable. Mussels likely would continue to free float through the system and ultimately be returned back to the lake. Furthermore, the aluminum floc forms a coating on the inside of piping, heat exchangers and other equipment using service water which helps inhibit zebra mussel settlement.

The copper ion generator is located downstream of the traveling water screens. Condenser cooling water zebra mussel treatment is not anticipated based on operational experience at other WEPCO facilities on Lake Michigan. This could differ at the ERGS units depending on the water quality from the off-shore intake location and metallurgy of the condenser tubing. At this time, there is not a specific plan for controlling zebra mussels in the condenser cooling water.

Treatment and discharge of storm water

NR 216 rules require that a storm water pollution prevention plan (SWPPP) be in place before commencement of construction activities that result in the disturbance of 5 acres or more of land and the operations phase of the proposed plants. Existing OCPP units 5 - 8 have a SWPPP in place and are permitted under NR 216 as a "Tier 2" facility. In general, under the requirements of the Wisconsin Pollution Discharge Elimination System (WPDES) storm water permit, an amendment of the plan must be done when changes to the facility result in a significant increase in the exposure of pollutants to storm water that are discharged to waters of the state or to storm water treatment devices. Most of the land area included in the SWPPP for the Tier 2 storm water permit are lands that have minimal potential for storm water contamination.

Therefore, the majority of the storm water management is regulated by the WPDES industrial discharge permit and not the NR 216 storm water permit. NR 216 requires that various types of best management practices (BMP's) be implemented to prevent storm water from contacting materials that can potentially contaminate it. Decisions on what BMP's are used are based upon site-specific information. Periodic inspections are performed to ensure that BMP's are performing at levels expected by the SWPPP.

Description and location of proposed storm water facilities

The quality of storm water discharged from the ERGS would be addressed through the development and implementation of site-specific construction site erosion control and post-construction storm water management plans. State and local regulations establish the design criteria, standards and specifications used to develop and implement these plans.

Construction site erosion control plan

The purpose of the erosion control plan is to minimize the discharge of sediment from the site to waters of the state (e.g., rivers, lakes and wetlands) during construction. This plan identifies specific erosion and sediment control practices that would be used to reduce the dislodging of soil particles and remove soil particles suspended in runoff.

State regulations require the erosion control plan to be designed to achieve an 80 percent reduction of the sediment load that would be discharged from the construction site if no sediment or erosion controls were in place. The Wisconsin Construction Site Best Management Practice Handbook contains the design criteria, standards and specifications for erosion and sediment control practices that are approved for use at construction sites in Wisconsin. Unfortunately, not all of the erosion and sediment control practices found in the Handbook are capable of controlling or removing sediment at an efficiency of 80 percent This means that the erosion control plan for the ERGS must include a combination of practices in order to achieve the 80 percent sediment reduction requirement.

It is anticipated that the erosion control plan for the ERGS would need to include the following critical elements in order to achieve the 80 percent sediment reduction requirement:

- As much of the construction site as possible should drain to sediment basins during all phases of construction. Changes in site topography and drainage patterns that would occur over time must be considered when determining the specific location of sediment basins. In addition, temporary diversion berms/swales may be needed to make sure the sediment basins are not bypassed.
- The area of bare soil exposed at any one time should be minimized. Any disturbed areas left inactive for seven days must be temporarily or permanently stabilized by seeding, mulching, erosion matting or other equivalent stabilization practices. Stabilization practices identified in the plan must be appropriate for site conditions and time of year.

Post-construction storm water management plan (excluding coal pile runoff)

The purpose of the post-construction storm water management plan is to minimize the discharge of pollutants from the developed site to waters of the state (e.g., rivers, lakes and wetlands). This plan identifies specific permanent storm water management practices that would be used to treat runoff from roadways, parking lots, rooftops and other significant sources of storm water pollutants.

State regulations require the storm water management plan to be designed to achieve an 80 percent reduction of the total suspended solids load that would be discharged from the developed site if no storm water treatment practices were in place.

Five wet detention basins would be used to treat storm water from the developed ERGS site and discharge treated storm water to Lake Michigan at two outfall locations. Wet detention basins designed in accordance with Wisconsin Department of Natural Resources Wet Detention Basin Technical Standard (Code 1001) can achieve the 80 percent total suspended solids reduction requirement. For optimum pollutant removal, a wet detention basin should have five-foot deep permanent pool of water with a surface area that is approximately 2 percent of drainage area to the basin. In addition, the wet detention basin outlet structure should be designed to provide a slow release of the runoff volume produced by the one-year 24-hour design storm.

Description of construction methods for storm water facilities

Construction site erosion controls

Critical sediment control practices including sediment basins, silt fence, and diversion berms/swales must be constructed or installed before land disturbing activities begin in other areas of the site (including clearing, grubbing and topsoil removal). Some sediment control practices would need to be re-installed or adjusted as appropriate during different phases of construction.

Temporary erosion control practices including seeding and/or mulching must be installed any time disturbed areas of the site are left inactive for seven days. Permanent erosion control practices including seeding and mulching or erosion matting are installed when final grades have been achieved and topsoil has been re-spread on unpaved areas and areas not covered by permanent structures.

Erosion and sediment control practices are installed or constructed by hand or using standard grading, excavating and landscaping equipment. Practices like erosion bales and erosion matting are installed by hand. Sediment basins are constructed with heavy equipment including scapers, dozers and backhoes. Soil stabilization practices are typically installed with the assistance of landscaping equipment including seeders and straw mulch blowers.

Post-construction storm water management facilities

Wet detention basins could be constructed at any time during site construction. Typically, wet detention basins are constructed first and used as sediment basins during site construction. As with sediment basin construction, wet detention basins are constructed with heavy equipment including scrapers, dozers and backhoes.

Potential impacts of construction

Disposal of excavated materials

Approximately five to ten million cubic yards of soil would need to be excavated to construct the ERGS. This soil would likely be stockpiled on-site. All soil stockpiles must be addressed in the erosion control plan including practices that would be used to minimize the impacts of trucks used to haul the excavated material (e.g., dust, sediment tracked on public roads). Changes in drainage patterns must be considered when siting soil stockpiles to make sure that changes in wetland hydrology are minimized.

Erosion control

State and local erosion control regulations do not establish water quality based effluent limitations for construction site runoff. However, the Wisconsin Department of Natural Resources considers the 80 percent sediment reduction requirement to be protective of waters of the state. The construction site should not have a significant adverse impact on waters of the state as long as the erosion control plan is designed to achieve 80 percent sediment reduction and the plan is properly implemented during all phases of construction.

Potential impacts of operation

State and local storm water regulations do not establish water quality based effluent limitation for new developments. However, the Wisconsin Department of Natural Resources considers the 80 percent total suspended solids reduction requirement to be protective of waters of the state. Storm water runoff from the developed ERGS should not have a significant impact on waters of the state as long as the storm water treatment facilities are designed to achieve 80 percent total suspended solids reduction. In addition, the Storm Water Pollution Prevention Plan (SWPPP) for the existing facility would need to be modified to include the new facility. The SWPPP would need to identify practices that would be used to minimize the amount and kind of materials exposed to storm water.

Differences among alternative sites

The three site alternatives proposed in the CPCN application (the North Site, the South Site, and the South Site-Exp) are similar in regards to construction site erosion control and post-construction storm water treatment. It is not anticipated that the erosion control and storm water treatment facilities would be significantly different for each alternative other than the actual location of the practices on the property. However, the city of Oak Creek recently adopted a storm water ordinance that would require storm water discharge quantity control for the ERGS. As a result, wet detention basins for the North Site would likely need to be somewhat larger than wet detention basins for the South Site and the South Site-Exp in order to provide the quantity control required by the city of Oak Creek.

Treatment and discharge of process wastewater

Wastewater sources would be similar to those of the existing units and would include yard drainage, coal pile runoff, neutralized demineralizer backwash, steam generator blowdown, non-chemical metal cleaning wastewater, floor drains, and other typical discharges present at a coal-based steam electric power plant. Treated wastewater would be discharged into Lake Michigan as currently done. Both federal (40 CFR Part 423) and state (Ch. NR 290, Wis. Admin. Code) regulations establish effluent limitations for power plants. Parameters typically limited for power plants utilizing once-through cooling are suspended solids, oil and grease, pH, and various metals. A WPDES wastewater discharge permit would limit the concentrations of potentially harmful constituents, and would include all of the requirements of the federal and state regulations. By meeting both federal and state water quality standards, adverse impacts to aquatic life would not be expected from the discharge of this treated wastewater. Treated discharges would also be required to pass whole effluent toxicity tests.

SCPC process wastewater

WEPCO plans to install a new wastewater treatment system that would treat the wastewater generated by the existing units 5-8 and the two new SCPC units. The proposed new wastewater treatment system would be designed to meet or exceed the discharge requirements under the WPDES permit. Ch. NR 108, Wis. Admin. Code, requires DNR review and approval of the treatment system before it can be put into operation. In general, the collection and treatment system would consist of coal pile runoff equalization and solids settling, ditches and pipes to convey wastewater, and the wastewater treatment equipment.

IGCC process wastewater

The IGCC process wastewater would be routed to either a treatment facility that also handles the existing units or a new facility to process only IGCC-related wastewater. The current plans are to construct a separate wastewater treatment system to handle discharges that are unique to the IGCC facility. Wastewater from the gasification process would be routed to a zero discharge wastewater treatment system dedicated to the IGCC facility. Discharges from other parts of the IGCC facility, mainly composed of flows from the combined-cycle power plant such as boiler blowdown, demineralizer regeneration wastewater and yard runoff, would be handled through a separate conventional treatment system and discharged to a Lake Michigan outfall.

Coal pile runoff

Coal pile runoff would be collected in ditches around the coal pile area and directed to a collection basin for flow equalization and solids settling. If additional wastewater treatment is necessary to further improve water quality, the collected runoff would be routed to a wastewater treatment plant and also may be used for coal pile dust control.

Limestone storage runoff

Limestone would be stored as-received on an open pile in a segregated area located on the existing coal dock. The storage pile would provide a supply of about 120 days for both SCPC units. The limestone would be pushed into a reclaim hopper and transported by conveyor to the crushers. Storm water runoff from the limestone storage pile is expected to be treated with the coal pile runoff.

Sanitary wastewater

Sanitary wastewater from plant bathrooms, showers and other employee areas would continue to be pumped into an on-site sewer that feeds the local Oak Creek sewer system. The local sewer is connected to the Milwaukee Metropolitan Sewerage District (MMSD) system. MMSD regulates and periodically monitors plant discharge quality.

New Railroad Facilities and the Potential Impacts on Wetlands

Description of facilities

Proposed changes to the Union Pacific (UP) railroad extend from just south of Elm Road to a location about 1,700 feet south of Five Mile Road. The proposed work includes realignment of the mainline track and the addition of several sections of new railroad tracks or sidings. One of the new sections on-site would be designated for the repair of coal train cars. All of the proposed work would be done on existing UP railroad right-of-way or WEPCO property. A new road underpass beneath the railroad grade has also been recommended by the applicants at Six Mile Road. Less certain, but still under consideration, is a vehicle underpass at Seven Mile Road. Both of these projects would require the acquisition of property.

Impacts of new facilities

There would be temporary impacts to the streams that cross under the railroad tracks during construction of new roadway and railroad facilities. These existing waterways and drainage ways would be maintained by extending existing culverts with either steel or concrete box culvert.

At Six Mile Road, where construction of an underpass is proposed, water drains or flows under Six Mile Road through culverts located west and east of the railroad tracks. These drainage flows connect to a navigable tributary that flows to Lake Michigan. The footprint of the new underpass would interfere with the culvert on the west side of the railroad tracks. The removal of this culvert would most likely be addressed by construction of a new drainage ditch along the north side of the new underpass.

With respect to drainage at Seven Mile Road, there is a stream (Rifle Range tributary) located about 200 feet east of the crossing. If an overpass or underpass were constructed at Seven Mile Road, enclosure of this stream for a distance of roughly 200 feet would be required. This stream has good macroinvertebrate habitat throughout the system which would be impacted by the proposed enclosure. The creation of new drainage ways for both Six and Seven Mile Road would impact on the quality of the streams and the habitat they provide.

The expansion and realignment of the realroad tracks would result in the filling of 9.32 acres of wetland located alongside the railroad corridor. Plans also call for the construction of new drainage ditches, which would impact the remaining 25.61 acres of wetland during and after construction. Without implementation of a specific re-vegetation plan, these newly constructed ditches would most likely be filled in by invasive and non-native species, further degrading any adjacent wetland or stream habitats. Erosion caused by construction activities could have additional impacts to wetlands hydraulically connected to the drainage ditches. Impacts to wildlife within the railroad corridor are expected to be minimal due to the current degraded nature of the vegetation, especially if construction activities were limited to the railroad corridor.

For information regardin the DNR wetlands permitting regulations and procedures refer to the previous section under "New and Modified On-shore Facilities and Potential Impacts on Wetlands and Streams."

The placement of fill in a wetland requires a Water Quality Certification from the DNR under s. 281.22 and s. 281.37, Wis. Stats. and NR 299, Wis. Adm. Code. Applicants must comply with NR 103, Wis. Adm. Code which requires the applicant to submit a Practicable Alternatives Analysis that evaluates alternatives which would avoid or minimize wetland impacts taking into consideration cost, available technology, and logistics in light of the overall project's purpose. The DNR will make a determination whether WEPCO has shown that no practicable alternative exists that would avoid or minimize impacts to the wetlands and whether the activities would result in significant adverse impacts on wetland functional values. DNR staff would work with WEPCO during the permitting process to evaluate the functional values of all wetlands and would encourage WEPCO to avoid or minimize the wetland impacts where practicably possible.